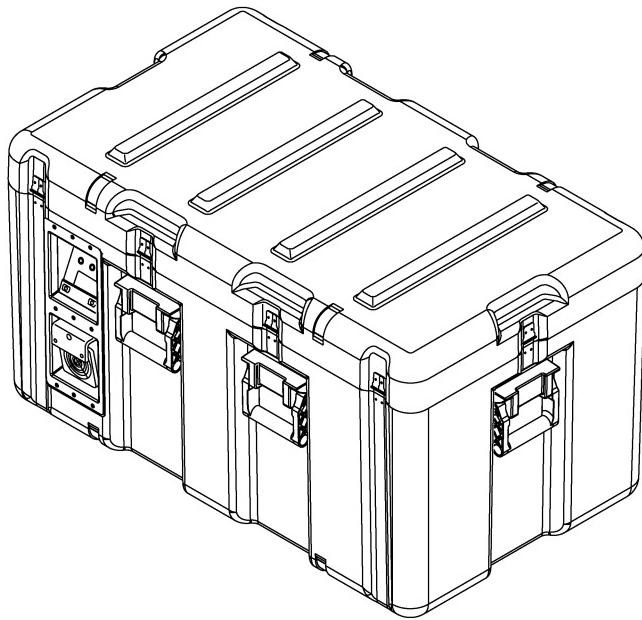


# **SERVICE MANUAL**

## **TWO-TEMPERATURE HemaCool®**

**Advanced Technology Blood Product Storage and Transport  
Refrigerator/Freezer  
Model HMC-MIL-1**

**NSN 4110-01-506-0895**



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**HemaCool® Service Manual**

**Revision 2**

**May 2005**



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## CHAPTER 1. GENERAL REPAIR WORK INFORMATION

### NOTE

This manual assumes that, when viewing the HemaCool®, the **front** is the side with the internal lid latches. The display screen is on the left when viewed from the front. Viewed from the front, the compressor and electronics compartment is on the left side of the unit, while the batteries are under the battery side tray on the right side.

#### 1-1. SCOPE

- a. After reading this manual you will be able to:
  - (1) Perform non-disassembly maintenance.
  - (2) Remove the air intake filters for cleaning.
  - (3) Examine and replace the lid gaskets.
  - (4) Perform required disassembly.
- b. Disassembly is required to:
  - (1) Change the fuses.
  - (2) Remove the air intake filter screens for cleaning.
  - (3) Change the battery set.
  - (4) Replace the fusible link assembly.
  - (5) Replace the lid gaskets.
  - (6) Replace the lid assembly.
  - (7) Replace the power supply.
  - (8) Replace the control motherboard.
  - (9) Replace the lithium battery.
  - (10) Replace the condenser fan assembly.
  - (11) Replace the display main pc board.
  - (12) Replace the compressor connector board.
- c. If it becomes necessary to call the factory for assistance, please be ready with:
  - (1) The unit's serial number.

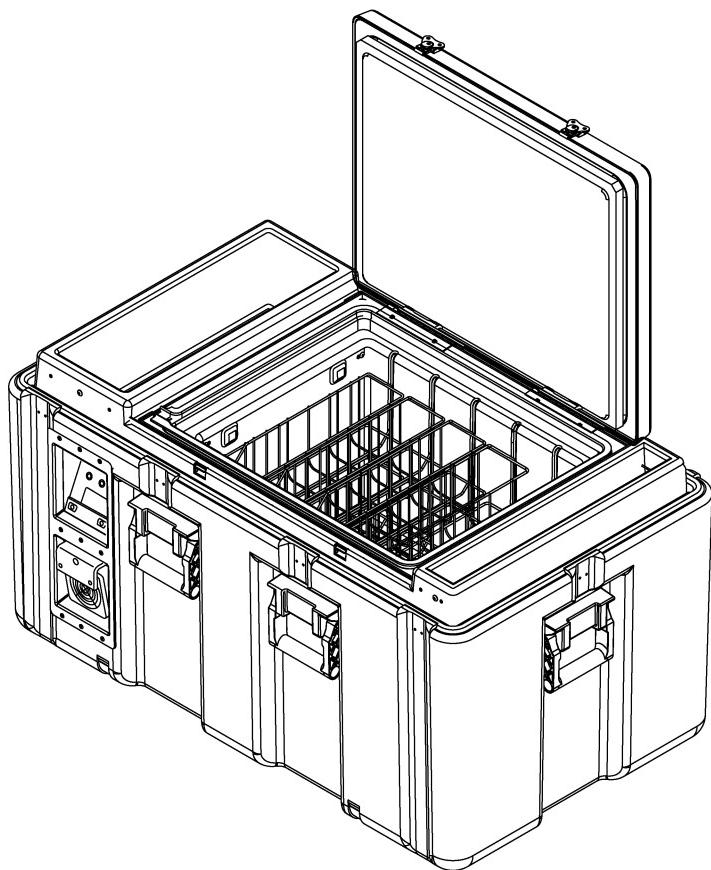
- (2) A list of symptoms or problems and the circumstances in which they occur.
  - (3) A record of everything you see on the display.
  - (4) Reference steps or illustrations in this manual to describe steps you've already taken.
- d. Inside the U.S., call toll-free 1-866-312-0114 and ask for HemaCool® technical support. Outside the U.S., dial 01-937-312-0114. Or, you may fax the information to 937-312-1277.

### 1-2. PRINCIPLES OF OPERATION

- a. The HemaCool® is a conventional liquid/vapor phase refrigerator with a number of special enhancements:
  - (1) It employs vacuum insulation panels to decrease the power required to regulate temperature in a given environment, increase holdover time when energy sources are lost or disconnected, and increase internal temperature stability.
  - (2) In its cooling mode (4°C (39°F) set point), the unit prevents payload freezing in subzero environments by applying heat rather than cooling.
  - (3) The unit's control system works with a number of different power sources without special adapters. This power system includes internal batteries that allow the HemaCool® to operate for a time without external power (see specifications).
  - (4) The HemaCool® includes integral payload compartment temperature monitoring and logging.
  - (5) The HemaCool's® internal design is arranged to accept baskets for holding blood bags (or fresh frozen plasma bags when the unit is operating in freezer mode).
  - (6) Small internal fans help circulate cooling air to maintain uniform temperature.
- b. The HemaCool® can be divided into three major components; cooling system, power and control system, and case.
- c. The cooling system consists of a compressor with an integral electronic drive module, a condensing coil, a roll-bonded evaporator coil, and connecting tubing. The evaporator has a temperature sensing thermistor and a heater strip attached by adhesives.
- d. The power and control system includes a power panel with inputs for 12-28 VDC auxiliary power, a universal input AC power converter to create DC from grid power or generators, the internal battery set, and power and control circuitry. DC power routing circuitry steers the DC through Schottky diodes to run the compressor or heater, fans, and to charge the internal batteries when the source is AC or DC auxiliary. It also powers all other circuitry except the data logger, which has its own long-life lithium battery. The control circuit board employs a microprocessor to monitor the thermistor on the evaporator to determine when to operate the compressor or heater. It also monitors a separate payload compartment thermistor to provide the temperature readout and to control alarms and warning lights. It sends the on/off signals and the audio alarm to the power board for routing to the compressor or heater. The display and warning lights are sent to the display board mounted on the display panel on the left side of the front of the unit.
- e. The case is the platform for mounting the cooling system, controls, insulation, and batteries and for assembling the payload compartment and internal lid inside the insulation envelope. It has a separate external lid to protect the internal refrigerator compartment and its lid from damage during transport. This lid may be left off during the stationary operation. The internal lid and its latches secure the seal necessary for the refrigeration compartment.

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- f. The assembled case is divided into three compartments (Figure 1-1):
- (1) The electronics compartment, which is on the left side when you face the display.
  - (2) The payload compartment, which is in the middle and is covered by a separate internal lid.
  - (3) The battery compartment, which is on the right side when you face the display.



**Figure 1-1.** HemaCool® Compartments

## HemaCool® Service Manual

- g. The electronics compartment holds the compressor, condenser, condenser fan, control, and power electronics and has the circulating air intake and exhaust ports. The power panel and display panel are also mounted from within this compartment. The air intake filters are mounted on the power panel and the display panel.
- h. The payload compartment has a liner that holds the blood bag baskets or other containers. The compartment also has the internal fans, lid switch, heater, and payload sensor.
- i. The battery compartment contains the batteries and fusible link assembly and is concealed by the cover panel plastic tray that serves as a compartment for cables and manuals or other items carried with the unit. When the cover panel is removed, the connector to the batteries is accessible.
- j. The display and control panel (Figure 1-2) mounts the LCD and LED display board used to monitor the HemaCool® performance. The board connects to the control board via a ribbon cable and connector. The panel also includes the RS-232 port and the infrared communication port device (IrDA standard) for the data logger.
- k. The power panel (Figure 1-3) in the compressor and electronics compartment has input connectors for auxiliary DC power and for an AC power cord. The AC connector is fused by two fuses on this panel. Two fuses are employed because the unit will operate on either 115 VAC or 230 VAC, the latter case requiring both nonground leads to be fused.



**Figure 1-2.** Display and Control Panel

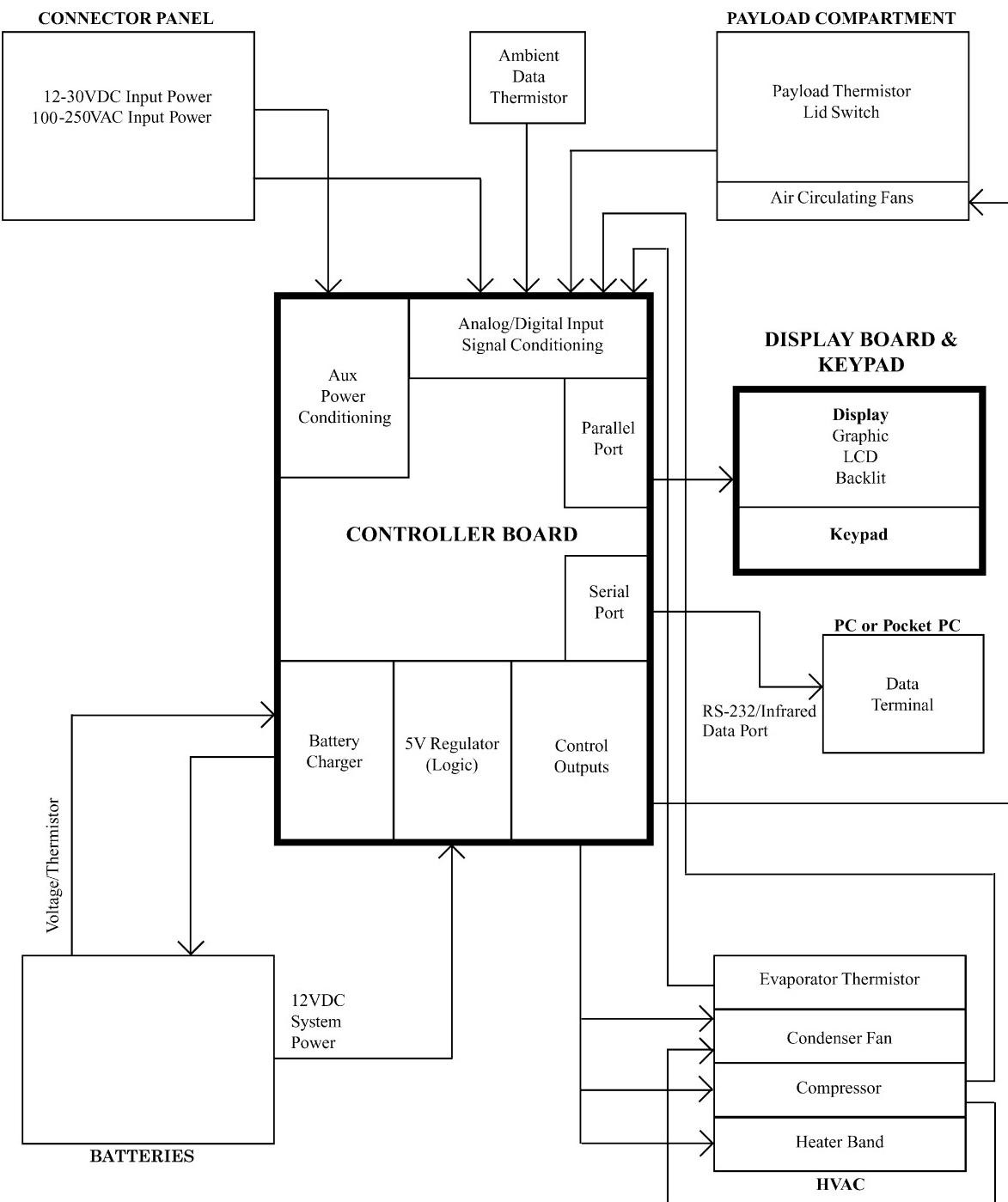


*Figure 1-3.* Power Panel

### **1-3. NORMAL OPERATION**

- a. Figure 1-4 is a functional block diagram of the HemaCool® as described below.
- b. In normal operation, the evaporator temperature sensor is monitored by the control board processor chip, which compares its output to an internal look-up table. This table lists the evaporator temperatures at which the compressor should turn on and off to maintain the temperature selected on the power panel. The on/off function is performed by an optically isolated MOSFET switch on the control board that is routed to the compressor through the power board. This switch acts in place of the conventional thermostat switch to tell the compressor driver to run the compressor and fans.
- c. The compressor can operate in two speed settings: slow or fast. Each time the compressor is started, it runs in slow speed. If the compressor runs continuously for 2 minutes, and the temperature has still not reached the desired target, the compressor switches to fast speed. It continues to run in fast speed until it cycles or is turned off.
- d. When the control temperature selection is changed, it tells the control board processor to use a different look-up table.
- e. Because thermal contact between the evaporator and the payload is made through air circulated by the internal fans, it is imperfect. In above zero ambient, the evaporator runs cooler than the payload temperature. The only exception is when the heater operates to prevent payload freezing from subfreezing ambient temperatures. Because of the temperature difference between the payload and the evaporator, as well as to have faster response, the temperature sensor for the evaporator is separate from the payload compartment temperature sensor and mounted directly on the evaporator.
- f. The payload compartment temperature sensor is monitored by the microprocessor to alert it to any failure of the temperature regulating system and to generate the temperature readout in the display. The processor takes a new reading of the temperature (and also of battery voltage) every 1.25 seconds. It averages 8 readings before updating the display. This means the display updates every 10 seconds and, if you make a change, you may not see it or you may see only part of it until at least 10 full seconds have elapsed.
- g. When the unit is operating on DC from its batteries or DC power, the internal and external fans operate only when the control board operates the compressor. When AC power is available, the AC to DC converter runs constantly to keep the batteries charged, and the condenser coil blower runs constantly to exhaust heat from the converter. The internal fans are switched through a magnetic reed switch on the payload compartment lid. This is so they turn off to prevent mixing excess warm outside air in, should you open the lid during compressor operation.
- h. Because the control board steers the different power sources together, any one of them can take over operating the unit if its voltage is higher. To ensure the AC supply takes over for the batteries and can charge them during operation, it is set at 16-17 volts.

**HemaCool® System  
Block Diagram**



**Figure 1-4.** Functional Block Diagram



## CHAPTER 2. MAINTENANCE PROCEDURES

### 2-1. PART REPLACEMENT MAINTENANCE PROCEDURES

- a. Before performing any maintenance on the unit, the following steps must be completed:

**WARNING**

- THE HEMACOOL® UNIT WEIGHS 142 LBS (64.4 KGS) EMPTY AND UP TO 180 LBS (81.7 KGS) LOADED. ALWAYS USE AT LEAST TWO PEOPLE WHEN LIFTING OR MOVING THE UNIT TO PREVENT PERSONAL INJURY.
- DISCONNECT ALL EXTERNAL POWER SOURCES BEFORE CONNECTING OR DISCONNECTING BATTERIES. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect AC power, if it is being used, by unscrewing, then pulling out the power cord collar from the AC power connector (1, Figure 2-1) at the bottom edge of the HemaCool® power panel.
  - (2) Disconnect any other external power, if it is being used, by unscrewing, then pulling out the large collar from the DC power connector (2) at the top edge of the HemaCool® power panel. The power panel should now have nothing visible plugged into it.
  - (3) Turn the unit off by depressing and holding the ON/OFF button (4, Figure 2-2) on the control panel for two seconds. Ensure the display (1) goes blank and none of the LEDs (2, 3) are illuminated on the display panel.

**NOTE**

- Before performing any maintenance, blood products should be moved to another storage unit.
  - All maintenance procedures require the case lid to be removed.
- (4) Proceed to make necessary parts replacements ONLY when the unit is disconnected from all external power and the unit is turned off as described above.

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**Figure 2-1.** HemaCool® Power Panel

## HemaCool® Service Manual



**Figure 2-2.** HemaCool® Display and Control Panel

## 2-2. REPLACING FUSES

### Required Test equipment

Continuity tester or ohmmeter

### Required Tools

None

### Required Parts

Two Fuses, PN 100523

#### a. Removal

#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES BEFORE CONNECTING OR DISCONNECTING BATTERIES. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.

#### **NOTE**

- There are only two replaceable fuses. They are located on the power panel.
- The power panel includes holders for two 3-AMP, 3AG-type fuses for AC power.

(1) Disconnect all external power sources (Para 2-1).

(2) Press inward on the fuse holder cap, turn it one quarter turn CCW, then pull it straight out.

#### **NOTE**

Sometimes vibration can break a fuse filament connection at one end, so the fuse may be defective even if the element appears intact.

(3) Use a continuity tester or ohmmeter to test each fuse.

(4) Replace either fuse if necessary.

(5) Press the cap and fuse into the fuse holder, then turn one quarter turn CW to lock in place.

## **2-3. CLEANING THE AIR INTAKE FILTERS**

### **Required Test Equipment**

None

### **Required Tools**

1/4-in. Flat-bladed screwdriver  
#2 Phillips-head screwdriver

### **Required Parts**

Replacement filters if needed, PN101964

### **NOTE**

- The case air intake filters in the HemaCool® should be checked monthly during normal indoor use and cleaned when the presence of dust or dirt is apparent. You can shine a flashlight into the air intake from the front of the unit and look up under the louvers to see accumulated dust. In dusty environments, check daily.
- You will need a supply of water or soap and water.

#### **a. Removal**

### **WARNING**

- THE HEMACOOL® UNIT WEIGHS 142 LBS (64.4 KGS) EMPTY AND UP TO 180 LBS (81.7 KGS) LOADED. ALWAYS USE AT LEAST TWO PEOPLE WHEN LIFTING OR MOVING THE UNIT TO PREVENT PERSONAL INJURY.
- DISCONNECT ALL EXTERNAL POWER SOURCES BEFORE CONNECTING OR DISCONNECTING BATTERIES. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR BEFORE REMOVING THE COVER PANEL OVER THE ELECTRONIC SECTION OF THE UNIT. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
  - (2) There are two filter assemblies. One is located in the bottom portion of the display and control panel (1, Figure 2-3) and one in the bottom portion of the power panel (1, Figure 2-4).

### **NOTE**

The top of each filter assembly (1) is locked in place by a recessed quarter-turn slotted stud (2) and the bottom edge is placed behind the two inner bezel rivets (3).

- (3) Insert a 1/4 -in. flat-bladed screwdriver through the center hole in the filter handle (4, Figure 2-3) of the display and control panel filter assembly (1). Turn the quarter-turn slotted stud (2) CCW to release the filter assembly (1).



**Figure 2-3.** Display and Control Panel Filter



*Figure 2-4.* Power Panel Filter

- (4) Grasp underneath the filter handle (4) and pull outward.
- (5) Remove the four screws (5) attaching the plastic filter (6) to the filter assembly (1).

**NOTE**

If the filter foam is damaged, it must be replaced.

- (6) Separate the plastic filter (6), then remove the foam filter.
- (7) Repeat steps (3) thru (6) for the power panel filter (1, Figure 2-4).

**b. Cleaning**

- (1) Clean the filters with running water or with mild soap (dish washing liquid soap is acceptable) and water.
- (2) Rinse filters thoroughly with fresh water.
- (3) After rinsing, blow the filters dry or allow to air-dry.

**c. Installation**

- (1) Install the foam filter into the plastic filter (6).
- (2) Install the plastic filter (6) and the four screws (5) to the filter assembly (1).
- (3) Place the bottom edge of the filter assembly (1) into the power panel behind the two inner bezel rivets (3).
- (4) Ensure that the slot in the quarter-turn stud (2) is vertical, then push the filter assembly (1) firmly in place.
- (5) Insert a 1/4 -in. flat-bladed screwdriver and turn the quarter-turn stud (2) CW until it is fully engaged.
- (6) Pull on the filter handle (4) to ensure that the filter assembly (1) is locked in place.
- (7) Repeat steps (1) thru (6) for the display and control panel filter (1, Figure 2-3).

## 2-4. REPLACEMENT OF BATTERIES

### Required Test Equipment

None

### Required Tools

#2 Phillips-head screwdriver  
1/4-in. Ratchet with a 5/16-in. socket

### Required Parts

Two batteries, PN 101880

#### a. Removal

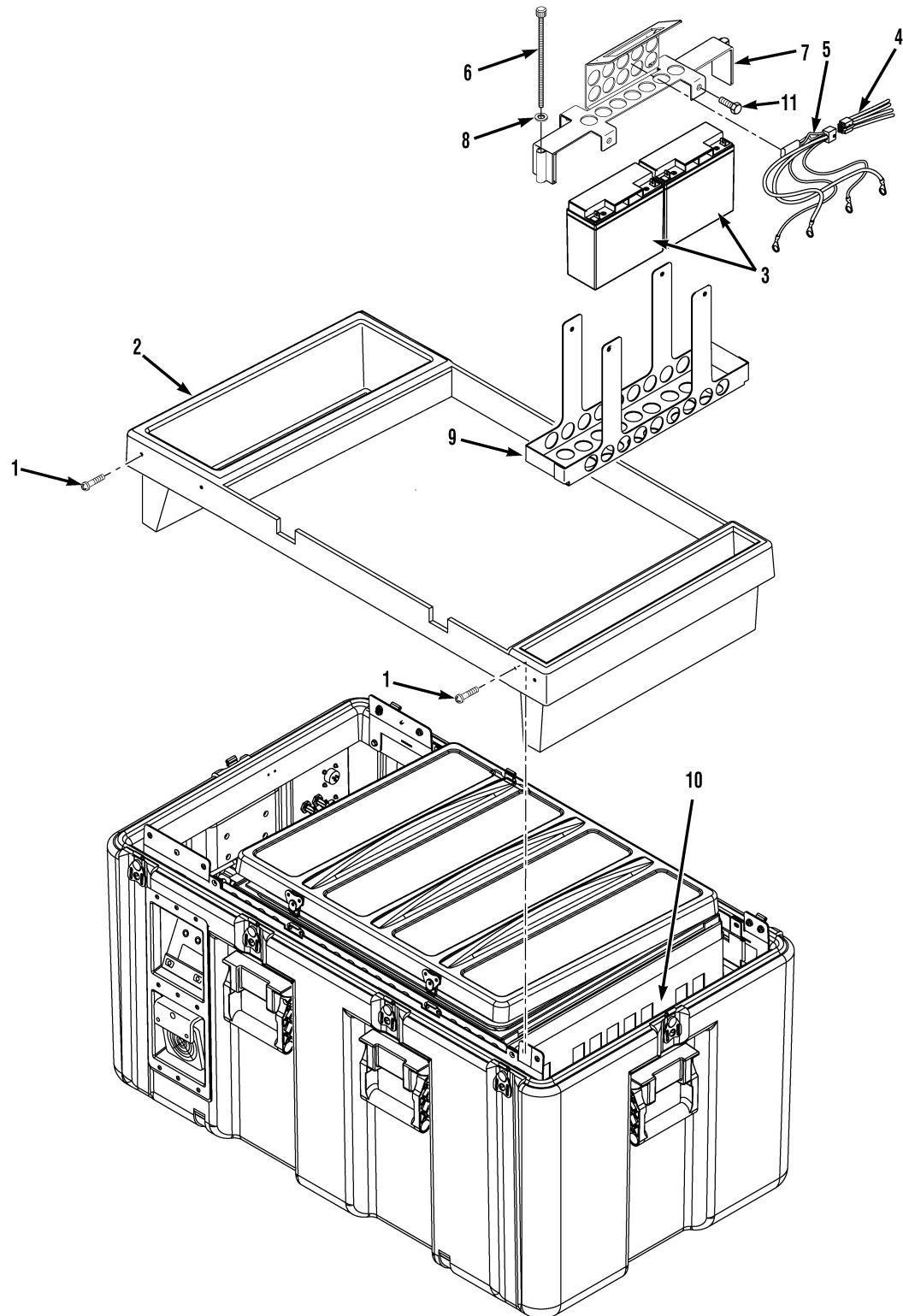
#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES BEFORE CONNECTING OR DISCONNECTING BATTERIES. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect all external power sources and prepare unit for maintenance (Para 2-1).
  - (2) Remove contents from the cover panel (2, Figure 2-5).
  - (3) Remove eight screws (1) and cover panel (2).
  - (4) Disconnect the batteries (3) by removing the battery power harness (4) from the fusible link assembly (5).
  - (5) Remove the two screws (6) and washers (8) that secure the battery lockdown bracket (7) to the chassis (10).

#### **CAUTION**

Care must be taken to not catch or pull against wiring during the following steps:

- (6) Grasp the battery lockdown bracket (7) by the handle and lift the battery assembly clear of the case.
- (7) Disconnect the negative and positive leads from the outer terminals of each battery (3).
- (8) Remove the four screws (11) from the battery lockdown bracket (7) and remove the bracket.
- (9) Lift the batteries (3) out of the battery compartment (9).



**Figure 2-5.** Replacement of Batteries

- (10) Disconnect the positive and negative leads from the inner terminals of each battery (3).

**b. Installation**



The fusible link wires going to the positive (+) battery terminals are YELLOW, while those going to the negative (-) terminals are BLACK. If these colors are accidentally reversed, it will not damage the HemaCool® unit, but a reverse-connected battery will not be able to provide power to the unit nor to receive charge from it. With one reverse-connected battery, battery powered cooling time will only be about 40% of what it is with both batteries properly connected. With both batteries reversed, the unit will only operate on AC power.

- (1) Connect the positive and negative leads to the inner terminals of each battery (3).
- (2) Lower the batteries (3) into the battery compartment (9).
- (3) Install the battery lockdown bracket (7) by attaching it with four screws (11).
- (4) Connect the negative and positive leads to the outer terminals of each battery (3).



Care must be taken to not catch or pull against wiring during the following steps. Ensure that the battery cable is positioned to clear the battery compartment. Failure to do so will result in the battery resting on top of the cable and the misalignment of the battery compartment mounting screws.

- (5) Lower the battery compartment (9) into place in the HemaCool® chassis (10).
- (6) Install the two screws (6) and washers (8) that secure the battery lockdown bracket (7) to the chassis (10).
- (7) Connect the batteries (3) by attaching the battery power harness (4) to the fusible link assembly (5).
- (8) Install the cover panel (2) with eight screws (1).

## 2-5. REPLACEMENT OF FUSIBLE LINK ASSEMBLY

### Required Test Equipment

None

### Required Tools

#2 Phillips-head screwdriver  
1/4-in. Ratchet with a 5/16-in. socket

### Required Parts

Fusible link assembly PN 100956  
Nylon wire ties

#### a. Removal

#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.

#### **NOTE**

The fusible link assembly includes the battery compartment temperature thermistor.

- (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
- (2) Remove contents from the cover panel (2, Figure 2-5).
- (3) Remove eight screws (1) and cover panel (2).
- (4) Disconnect the batteries (3) by removing the battery power harness (4) from the fusible link assembly (5).
- (5) Remove the two screws (6) and two washers (8) that secure the battery lockdown bracket (7) to the chassis (10).

#### **CAUTION**

Care must be taken to not catch or pull against wiring during the following steps:

- (6) Grasp the battery lockdown bracket (7) by the handle and lift the battery assembly clear of the case.
- (7) Disconnect the negative and positive leads from the outer terminals of each battery (3).
- (8) Remove the four screws (11) from the battery lockdown bracket (7) and remove the bracket.

- (9) Lift the batteries (3) out of the battery compartment (9).
- (10) Disconnect the positive and negative leads from the inner terminals of each battery (3).
- (11) Cut the nylon wire ties that attach the fusible link assembly (5) to the battery lockdown bracket (7).

**b. Installation**

- (1) Install the fusible link assembly (5) to the battery lockdown bracket (7) using nylon wire ties.



The fusible link wires going to the positive (+) battery terminals are YELLOW, while those going to the negative (-) terminals are BLACK. If these colors are accidentally reversed, it will not damage the HemaCool® unit, but a reverse-connected battery, battery powered cooling time will only be about 40% of what it is with both batteries properly connected. With both batteries reversed, the unit will only operate on AC power.

- (2) Connect the positive and negative leads to the inner terminals of each battery (3).
- (3) Lower the batteries (3) into the battery compartment (9).
- (4) Install the battery lockdown bracket (7) by attaching it with four screws (11).
- (5) Connect the negative and positive leads to the outer terminals of each battery (3).



Care must be taken to not catch or pull against wiring during the following steps. Ensure that the battery cable is positioned to clear the battery compartment. Failure to do so will result in the battery resting on top of the cable and the misalignment of the battery compartment mounting screws.

- (6) Lower the battery compartment (9) into place in the HemaCool® chassis (10).
- (7) Install the two screws (6) and the two washers (8) that secure the battery lockdown bracket (7) to the chassis (10).
- (8) Connect the batteries (3) by attaching the battery power harness (4) to the fusible link assembly (5).
- (9) Install the cover panel (2), and eight screws (1).

## 2-6. REPLACEMENT OF INNER LID GASKET

### Required Test Equipment

None

### Required Tools

Putty knife  
Isopropyl alcohol  
Sharp knife

### Required Parts

Lid gasket, PN 100868

#### a. Removal

#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
  - (2) Open the inner lid (1, Figure 2-6).
  - (3) Remove the lid gaskets (2) and adhesive from the inner lid (1) surface using a putty knife at a shallow angle.

#### **WARNING**

ALCOHOL IS FLAMMABLE AND TOXIC TO SKIN, EYES, AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION IS REQUIRED. AVOID REPEATED OR PROLONGED CONTACT. USE IN A WELL-VENTILATED AREA.

- (4) Remove adhesive residue from inner lid (1) by wiping with a soft, clean cloth moistened with isopropyl alcohol.

**b. Installation**

**NOTE**

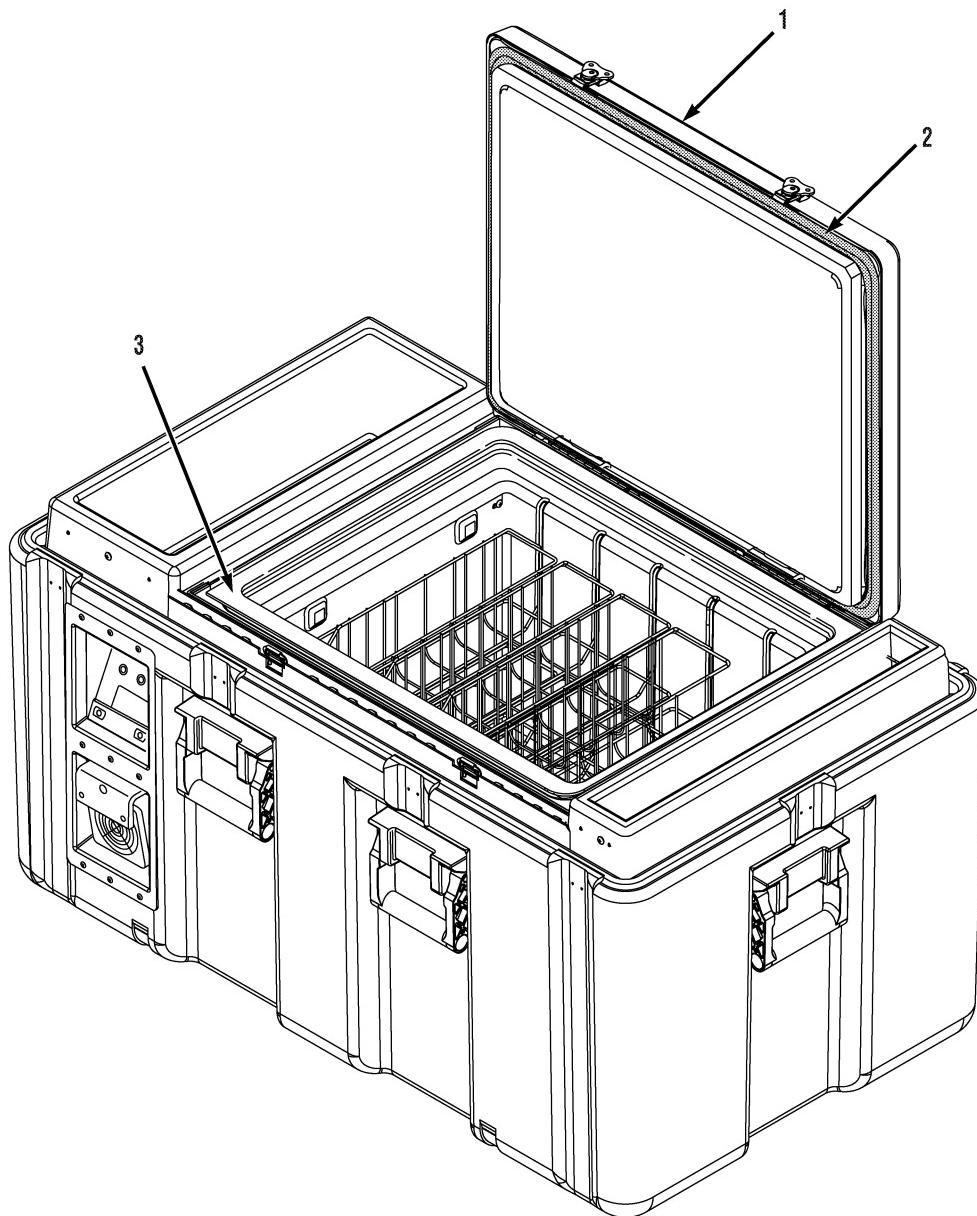
- Lid gasket is shipped as a two-rib unit and must be separated into two single-rib gaskets.
- Gasket ribs must be installed with end seams staggered to prevent leakage.
- Ends of ribs may need to be trimmed to fit, with a sharp knife.

- (1) Separate the two ribs of gasket by pulling apart lengthwise.
- (2) Prior to removing backing from pressure sensitive adhesive, test fit inner and outer ribs. Trim to appropriate length.
- (3) Remove backing from the pressure-sensitive adhesive on lid gaskets (2).

**NOTE**

In the following step it will become necessary to install the inner gasket first, duplicating the original gasket's position.

- (4) Starting on the hinge side of the lid opening, install the replacement lid gaskets (2).
- (5) Inspect lid gaskets (2) and mating surface (3) for positive sealing before resuming normal operation.



*Figure 2-6.* Replacement of Inner Lid Gaskets

## 2-7. REPLACEMENT OF INNER LID ASSEMBLY

### Required Test Equipment

None

### Required Tools

#1 Phillips-head screwdriver  
#2 Phillips-head screwdriver  
1/4-in. Flat-bladed screwdriver

### Required Parts

Lid Assembly, PN 100850

#### a. Removal

#### **WARNING**

- THE HEMACOOL® UNIT WEIGHS 142 LBS (64.4 KGS) EMPTY AND UP TO 180 LBS (81.7 KGS) LOADED. ALWAYS USE AT LEAST TWO PEOPLE WHEN LIFTING OR MOVING THE UNIT TO PREVENT PERSONAL INJURY.
- DISCONNECT ALL EXTERNAL POWER SOURCES BEFORE CONNECTING OR DISCONNECTING BATTERIES. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
  - (2) Remove the eight screws (1, Figure 2-5) and cover panel (2).
  - (3) Ensure that the lid latches (2, Figure 2-7) are in the unlatched position.

#### **CAUTION**

- The following steps will require two persons. One person is required to apply downward pressure to the lid, while the other person removes or installs the lid screws. To avoid damage to the screw threads, apply downward pressure to the lid, above the hinges.
- The lid hinge screws are positioned below the top of the outer case, therefore the Phillips-head screwdrivers will be inserted and used at an angle to the screws. To eliminate damage to the screw heads, it is important that the screwdrivers are firmly seated into the screw heads and ample inward pressure is used.

(4) Apply downward pressure to the lid (1), above each hinge (3). Using a #1 Phillips-head screwdriver, remove the outer screw (4) of each hinge (3), then remove the inner screw (5).

(5) Raise the lid (1) vertically to remove.

**b. Installation**

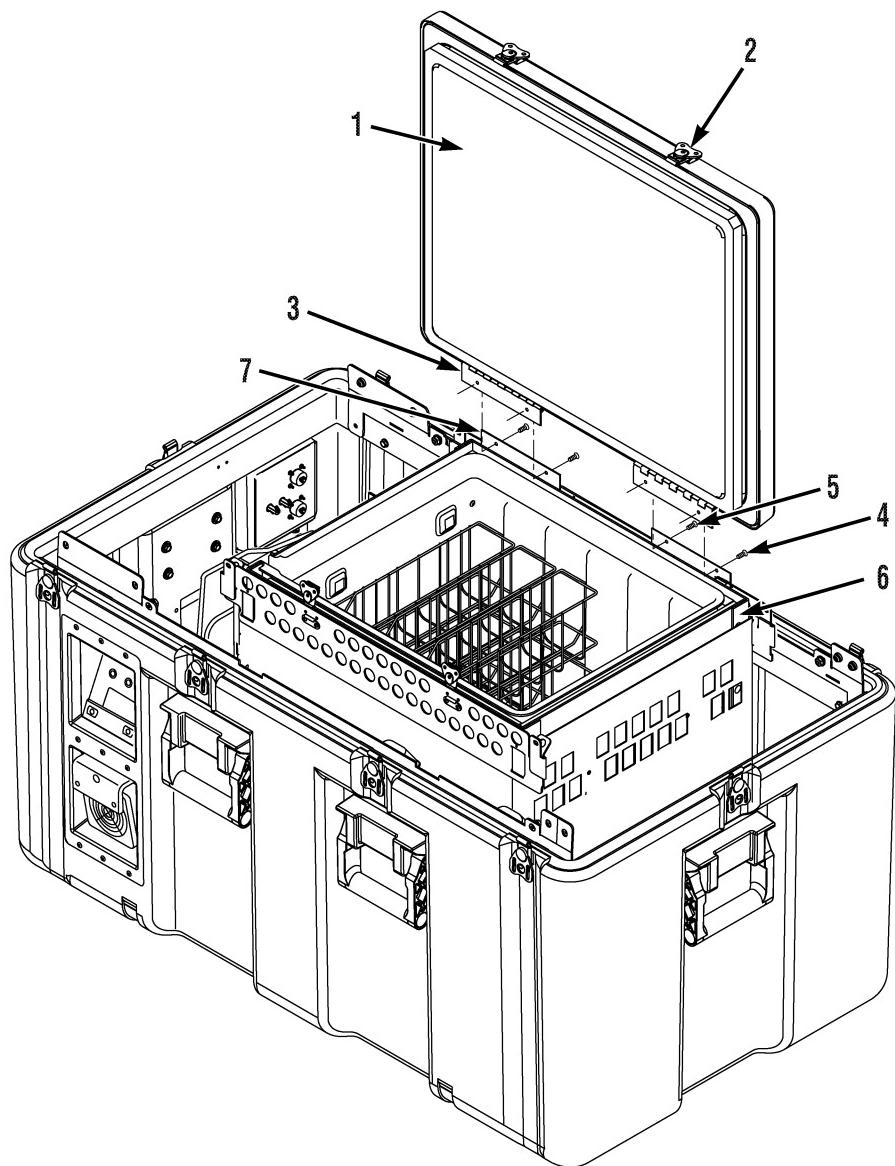
**NOTE**

In the following step, it may become necessary for one person to pull outward on the top rear lip of the outer case to allow the hinges to be inserted between the chassis hinge tabs and the rim cover.

(1) Lower the lid (1) vertically, ensure the lid hinges (3) are inserted and aligned between the rim cover (6), and the chassis hinge tabs (7). Close the lid.



- The following steps will require two persons. One person is required to apply downward pressure to the lid, while the other person removes or installs the lid screws. To avoid damage to the screw threads, apply downward pressure to the lid, above the hinges.
  - The lid hinge screws are positioned below the top of the outer case, therefore the Phillips-head screwdrivers will be inserted and used at an angle to the screws. To eliminate damage to the screw heads, it is important that the screwdrivers are firmly seated into the screw heads and ample inward pressure is used.
- (2) Insert a 1/4-in. flat-bladed screwdriver between the rim cover (6) and the lid hinge (3) ensuring the lid hinge (3) is firmly against the chassis hinge tab (7).
- (3) Apply downward pressure to the closed lid (1), above each hinge (3), and align the screw holes. Using a #1 Phillips-head screwdriver, install the outer screws (4), then install the inner screws (5).
- (4) Tighten all four hinge screws (4, 5) firmly with a #2 Phillips-head screwdriver.
- (5) Install the cover panel (2, Figure 2-5) with eight screws (1).



**Figure 2-7.** Replacement of Inner Lid Assembly

## 2-8. REPLACEMENT OF POWER SUPPLY

### Required Test Equipment

None

### Required Tools

#2 Phillips-head screwdriver  
1/4-in. Ratchet with a 3/8-in. socket  
1/4-in. Flat-bladed screwdriver

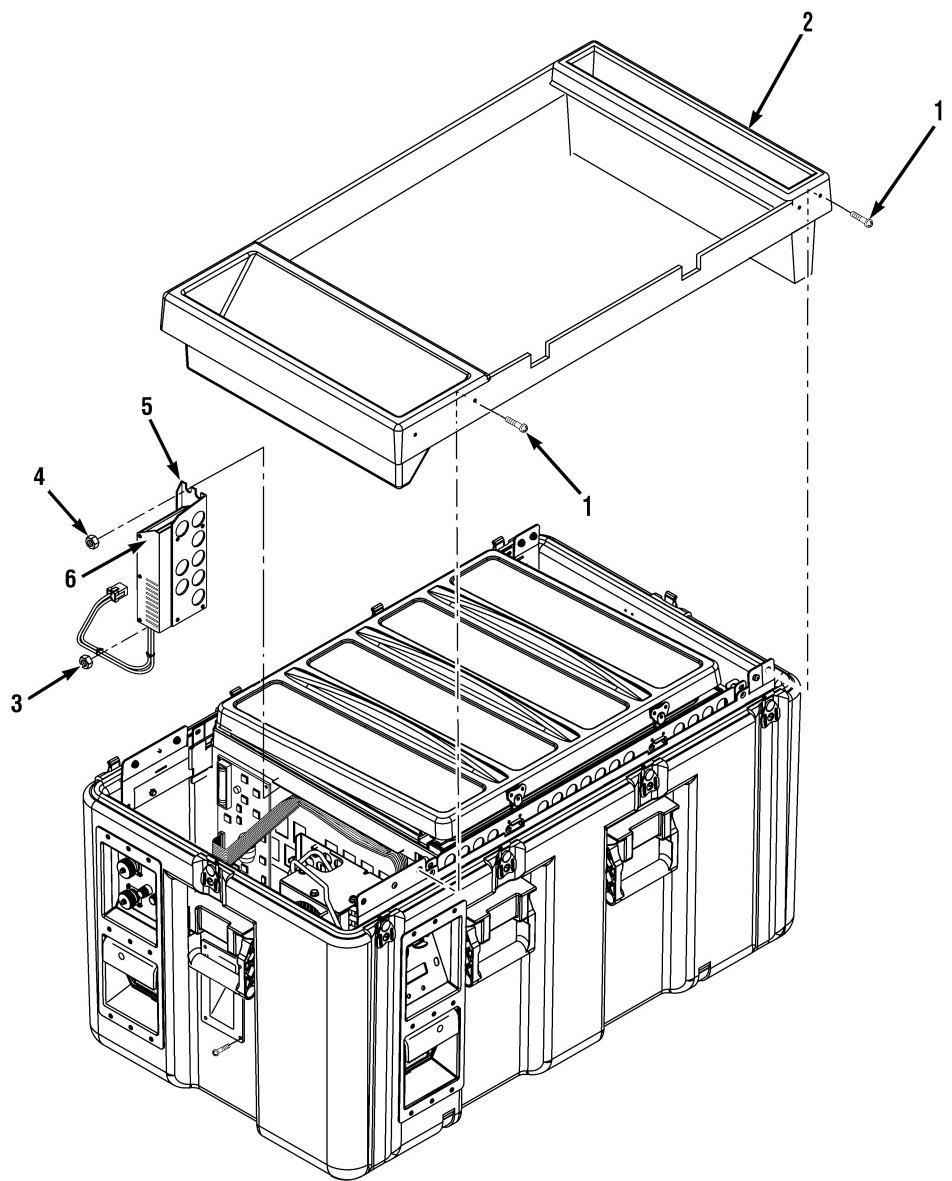
### Required Parts

Power Supply, PN 101763  
Small nylon wire ties

#### a. Removal

#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
  - (2) Remove eight screws (1, Figure 2-8) and cover panel (2).
  - (3) Disconnect the batteries (3, Figure 2-5) by removing the battery power harness (4) from the fusible link assembly (5).
  - (4) Disconnect the 5-pin wire harness from the power panel.
  - (5) Cut the two nylon wire ties that secure the power supply wiring to the power supply (6, Figure 2-8)



*Figure 2-8.* Replacement of Power Supply

**NOTE**

- The power supply wiring is connected to a terminal strip located on the top of the power supply (6).

• All wires must be tagged and marked prior to removal.

- (6) Label the power supply wiring attached to the terminal strip.
- (7) Loosen the two 3/8-in. nuts (3) that hold the bottom of the power supply bracket (5) to two bolts attached to the chassis.
- (8) Remove the two 3/8-in. nuts (4) that hold the top of the power supply bracket (5) to two bolts attached to the chassis.
- (9) Grasp the power supply bracket (5) and slide it up about 1/2 in., then retract the power supply (6) and bracket (5).
- (10) Remove the power supply wiring from the terminal strip.
- (11) Remove four screws and the power supply (6) from the power supply bracket (5).

**b. Installation**

- (1) Install four screws and the power supply (6) to the power supply bracket (5).
- (2) Lower the power supply bracket (5) into the electronics compartment, then connect the power supply wires as marked to the terminal strip on the top of the power supply (6).
- (3) Put the power supply bracket (5) in position over the two bottom bolts attached to the chassis and tighten the two 3/8-in. nuts (3).
- (4) Install the two 3/8-in. nuts (4) that hold the top of the power supply bracket (5) to the two bolts attached to the chassis.
- (5) Install two nylon wire ties and secure the power supply wiring to the power supply (6).
- (6) Connect the 5-pin wire harness to the power panel.
- (7) Connect the batteries (3, Figure 2-5) by attaching the battery power harness (4) to the fusible link assembly (5).
- (8) Install the cover panel (2) with eight screws (1).

## 2-9. REPLACEMENT OF CONTROL MOTHERBOARD

### Required Test Equipment

None

### Required Tools

#1 Phillips-head screwdriver  
1/4-in. Ratchet with a 3/8-in. socket

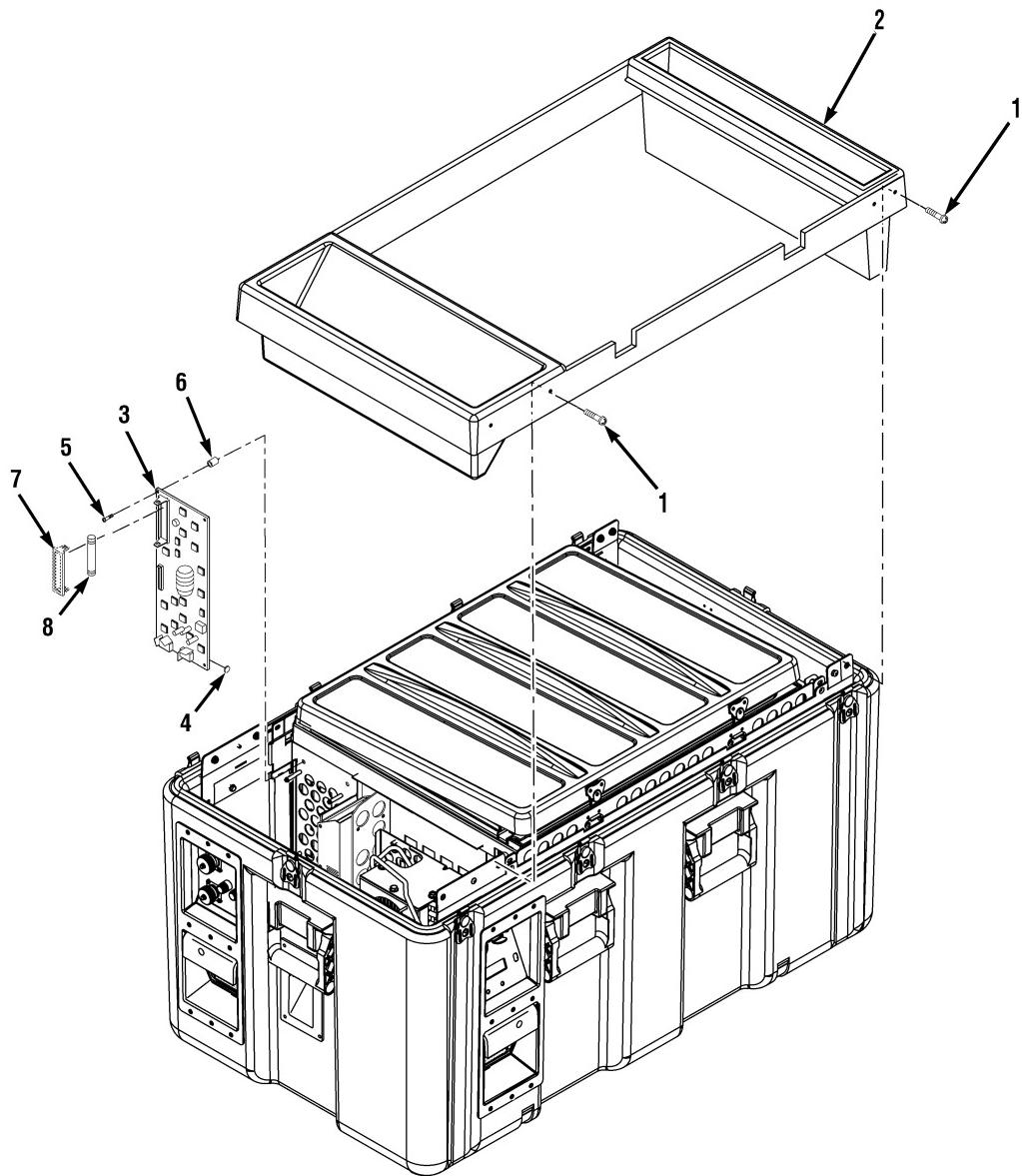
### Required Parts

Control motherboard, PN 100889

#### a. Removal

#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES BEFORE CONNECTING OR DISCONNECTING BATTERIES. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
  - (2) Remove eight screws (1, Figure 2-9) and cover panel (2).
  - (3) Disconnect the batteries (3, Figure 2-5) by removing the battery power harness (4) from the fusible link assembly (5).
  - (4) Remove the ribbon cable from the control motherboard (3, Figure 2-9) by releasing the end levers and pulling the ribbon cable straight out.
  - (5) Disconnect the four wire harness connectors from the control motherboard (3).
  - (6) Remove the bottom left 3/8-in. nut (3, Figure 2-8) that holds the control motherboard ground wire (4, Figure 2-9).
  - (7) Remove the control motherboard ground wire (4) from the bolt attached to the chassis.



**Figure 2-9.** Replacement of Control Motherboard

**NOTE**

In the following step a 3/16-in. nylon spacer is installed behind each board-mounting screw and must be captured for reinstallation of the control board.

- (8) Carefully remove the six screws (5) attaching the control motherboard (3) to the chassis. Capture the six spacers (6), and remove the control motherboard.

**b. Installation**

**NOTE**

To reinstall the control motherboard, it will become necessary to make captive to the board the nylon spacers. Compress the spacers with a pair of pliers, insert the board-mounting screws through the board and spacers, then remount the board to the frame.

- (1) Install the control motherboard (3) to the chassis using the six screws (5) and six spacers (6).
- (2) Connect the four wire harness connectors to the control motherboard (3).

**NOTE**

The ribbon cable is reinstalled with the brown side to the top of the harness inlet.

- (3) Connect the ribbon cable to the control motherboard (3) by inserting the cable and latching the end levers inward.
- (4) Install the control motherboard ground wire (4) to the bottom left power supply bracket chassis bolt (3, Figure 2-8).
- (5) Connect the batteries (3, Figure 2-5) by attaching the battery power harness (4) to the fusible link assembly (5).
- (6) Install the cover panel (2, Figure 2-9) with eight screws (1).

## 2-10. REPLACEMENT OF 3.6 VOLT LITHIUM BACKUP BATTERY

### Required Test Equipment

None

### Required Tools

#2 Phillips-head screwdriver

### Required Parts

Lithium ion battery, PN 103014

#### a. Removal

#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES BEFORE CONNECTING OR DISCONNECTING BATTERIES. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.

#### **NOTE**

All data points will be lost when the lithium battery and all power sources are removed from the unit.

- (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
- (2) Remove eight screws (1, Figure 2-9) and cover panel (2).
- (3) Disconnect the batteries (3, Figure 2-5) by removing the battery power harness (4) from the fusible link assembly (5).
- (4) Remove the retaining clip (7, Figure 2-9) from the battery receptacle by expanding the end tabs and pulling outward.
- (5) Remove the 3.6 volt lithium battery (8) from the control motherboard (3).

**b. Installation**

**NOTE**

- If removing the 3.6 volt lithium battery is being done to clear all data from the display board, replacing the lithium battery will not be necessary.
  - The 3.6 volt lithium battery is installed with the positive terminal down.
- (1) Install the 3.6 volt lithium battery (8) into the control motherboard (3) with the positive terminal down.
  - (2) Install the retaining clip (7) by aligning it over the battery and pushing inward until both end tabs are securely locked to the battery receptacle.
  - (3) Connect the batteries (3, Figure 2-5) by attaching the battery power harness (4) to the fusible link assembly (5).
  - (4) Install the cover panel (2, Figure 2-9) with eight screws (1).

## **2-11. REPLACEMENT OF CONDENSER FAN ASSEMBLY**

### **Required Test Equipment**

None

### **Required Tools**

#2 Phillips-head stubby screwdriver

### **Required Parts**

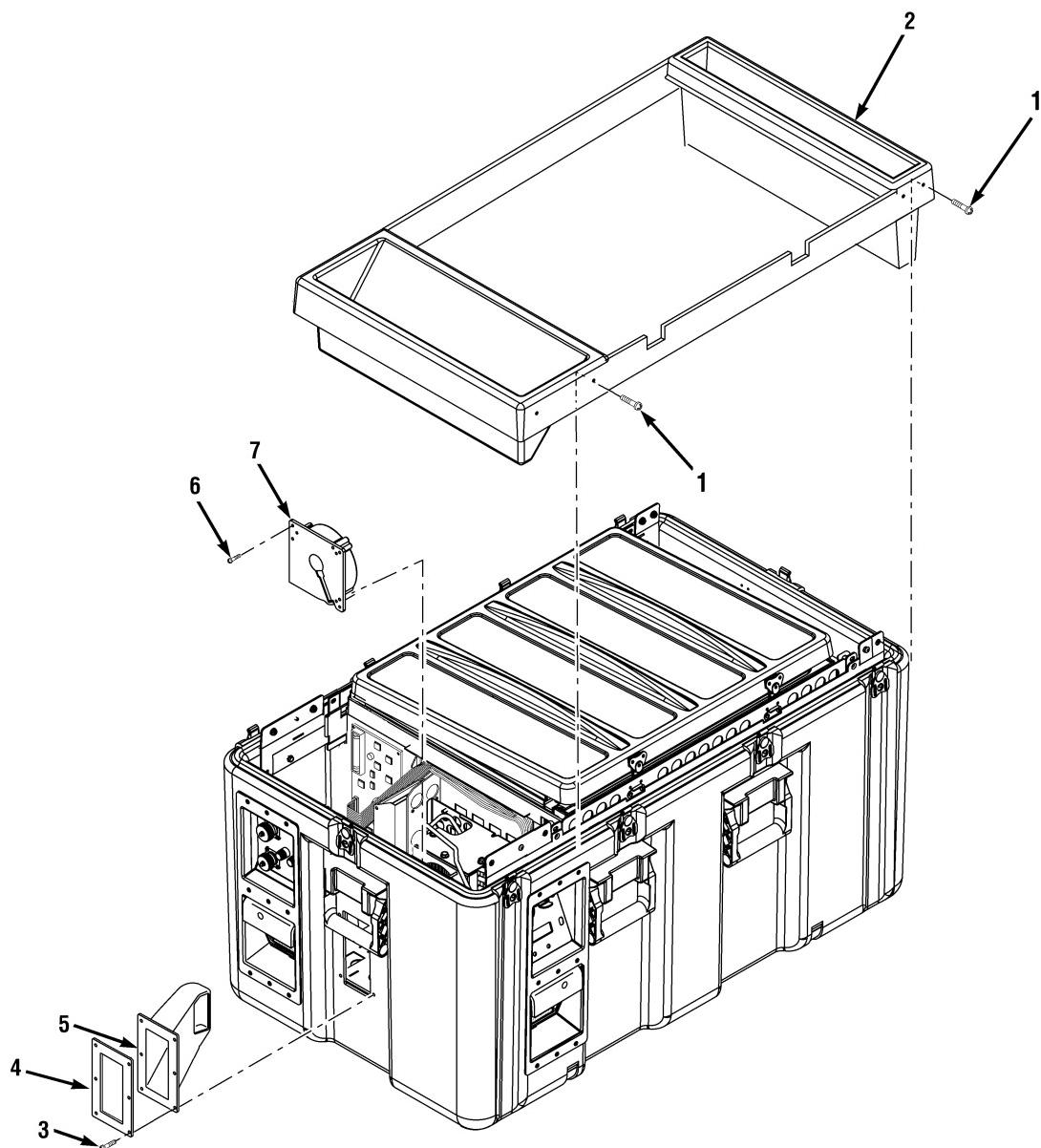
Condenser blower fan, PN 100801

Small nylon wire tie

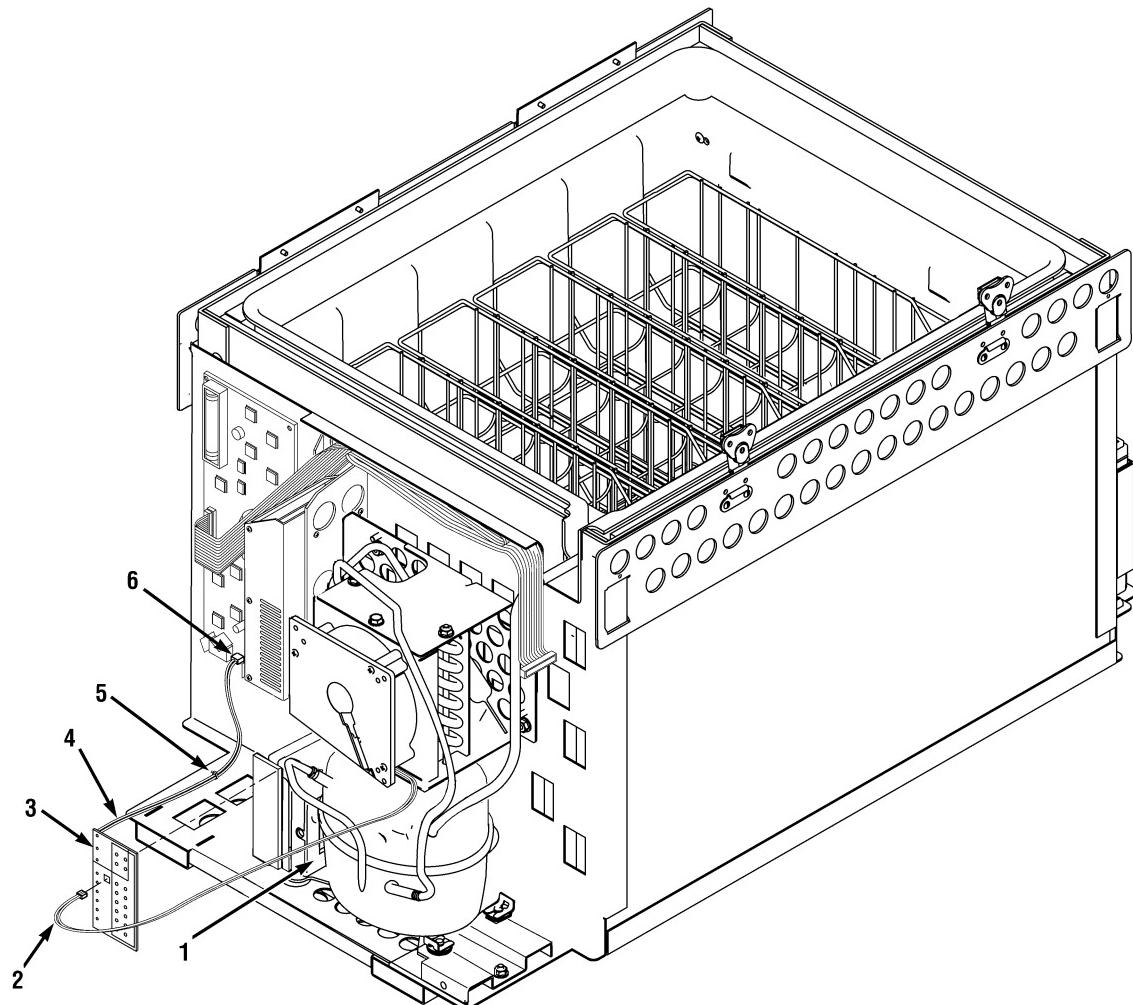
#### **a. Removal**

#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
  - (2) Remove eight screws (1, Figure 2-10), and cover panel (2).
  - (3) Disconnect the batteries (3, Figure 2-5) by removing the battery power harness (4) from the fusible link assembly (5).
  - (4) Remove the six screws (3, Figure 2-10), exhaust panel plate (4), and the air exhaust duct (5) from the case.
  - (5) Cut the nylon wire tie that holds the condenser fan assembly wire harness (2, Figure 2-11) to the compressor process stub.
  - (6) Disconnect the condenser fan assembly wire harness (2) from the compressor connector board (3).
  - (7) Remove three screws (6, Figure 2-10) attaching the condenser fan assembly (7) to the fan mount bracket.



**Figure 2-10.** Replacement of Condenser Fan Assembly



**Figure 2-11.** Replacement of Compressor Connector Board

**b. Installation**

- (1) Install the condenser fan assembly (7) to the fan mount bracket using the three screws (6).
- (2) Connect the condenser fan assembly wire harness (2, Figure 2-11) to the compressor connector board (3).
- (3) Attach the condenser fan assembly wire harness (2) to the compressor process stub with a nylon wire tie.
- (4) Install the air exhaust duct (5, Figure 2-10), exhaust panel plate (4), and the six screws (3) to the case.
- (5) Connect the batteries (3, Figure 2-5) by attaching the battery power harness (4) to the fusible link assembly (5).
- (6) Install the cover panel (2, Figure 2-10) with eight screws (1).

## 2-12. REPLACEMENT OF DISPLAY MAIN PC BOARD

### Required Test Equipment

None

### Required Tools

- #1 Phillips-head right angle screwdriver
- #2 Phillips-head screwdriver
- 1/4-in. Flat-bladed screwdriver
- 1/4-in. Ratchet with a 3/16-in. socket or 3/16-in. nutdriver

### Required Parts

Display main PC board, PN 100899

#### a. Removal

#### **WARNING**

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- DISCONNECT ALL EXTERNAL POWER SOURCES. REMOVE THE CASE LID THEN REMOVE THE COVER PANEL AND DISCONNECT BATTERIES BEFORE PERFORMING MAINTENANCE OR SERVICE. FAILURE TO COMPLY MAY RESULT IN INJURY OR DEATH TO PERSONNEL.
  - (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
  - (2) Remove eight screws (1, Figure 2-10) and cover panel (2).
  - (3) Disconnect the batteries (3, Figure 2-5) by removing the battery power harness (4) from the fusible link assembly (5).
  - (4) Remove the two screws from the data port located at the top, right corner of the display panel.
  - (5) Detach the ribbon cable (1, Figure 2-12) from the display board (2) by releasing the lock latches outward, then pulling the ribbon cable straight out.

#### **NOTE**

In the following step a nylon spacer is installed behind each board mounting screw and must be captured for reinstallation of the board.

- (6) Carefully remove the four Phillips-head screws (3) attaching the display board (2) to the control panel bracket and capture the spacers (4).
- (7) Detach the LCD ribbon from the display panel at the display board (2), then remove the board.

**b. Installation**

**NOTE**

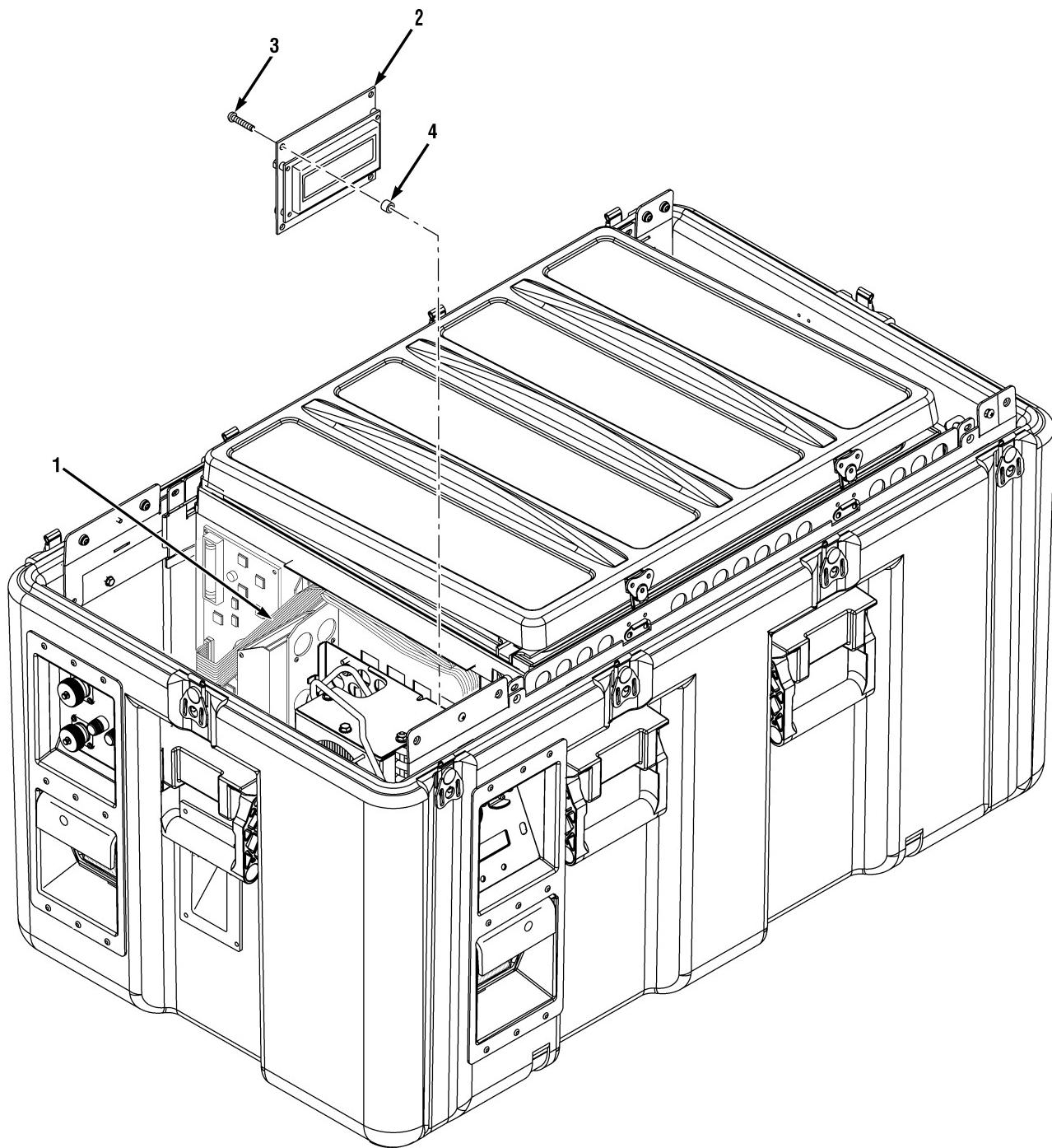
To reinstall the display board, it will become necessary to make captive to the board, the nylon spacers. Compress the spacers with a pair of pliers, insert the board-mounting screws through the board and spacers, then remount the board to the frame.

- (1) Make captive to the board (2) the four Phillips-head mounting screws (3) and spacers (4).
- (2) Attach the LCD ribbon from the display panel to the display board (2).
- (3) Install the display board (2), screws (3), and spacers (4) to the control panel bracket.

**NOTE**

The ribbon cable to the display board is reinstalled with the purple side to the right side of the unit.

- (4) Connect the ribbon cable (1) to the display board (2) by inserting the ribbon cable and latching the end levers inward.
- (5) Install the data port at the top, right corner of the display panel using the two screws.
- (6) Connect the batteries (3, Figure 2-5) by attaching the battery power harness (4) to the fusible link assembly (5).
- (7) Install cover panel (2) with eight screws (1).



**Figure 2-12.** Replacement of Display Main PC Board

## 2-13. REPLACEMENT OF COMPRESSOR CONNECTOR BOARD

### Required Test Equipment

None

### Required Tools

#2 Phillips-head screwdriver

### Required Parts

Compressor power harness, PN 101839

Nylon wire tie

#### a. Removal

#### **WARNING**

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#### **NOTE**

To replace the compressor connector board, it is necessary to replace the compressor power harness.

- (1) Disconnect all external power sources and prepare the unit for maintenance (Para 2-1).
- (2) Remove eight screws (1, Figure 2-10) and cover panel (2).
- (3) Disconnect the batteries (3, Figure 2-5) by removing the battery power harness (4) from the fusible link assembly (5).
- (4) Remove the six screws (3, Figure 2-10) exhaust panel plate (4), and the air exhaust duct (5) from the case.
- (5) Cut off the nylon wire tie (5, Figure 2-11) attaching the compressor power harness (4) to the chassis.
- (6) Disconnect the condenser fan assembly wire harness (2) from the compressor connector board (3).
- (7) Disconnect the compressor connector board (3) from the compressor electronic unit (1)
- (8) Disconnect the compressor power harness (4) from the control motherboard (6).

**b. Installation**

- (1) Connect the compressor power harness (4) to the control motherboard (6).
- (2) Connect the compressor connector board (3) to the compressor electronic unit (1).
- (3) Connect the condenser fan assembly wire harness (2) to the compressor connector board (3).
- (4) Install a nylon wire tie (5) and attach the compressor power harness (4) to the chassis.
- (5) Install the air exhaust duct (5, Figure 2-10), exhaust panel plate (4) and the six screws (3) to the case.
- (6) Connect the batteries (3, Figure 2-5) by attaching the battery power harness (4) to the fusible link assembly (5).
- (7) Install the cover panel (2, Figure 2-10) with eight screws (1).

## 2-14. TROUBLESHOOTING

General Troubleshooting Instructions

### WARNING

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  - a. Always read warnings in applicable removal and installation procedures.
  - b. Obtain as much information as possible from the operator and from the HemaLog.
  - c. If the unit does not operate properly:
    - (1) Find the title that best describes the trouble.

Symptom	Figure
Unit does not work	2-13
Payload temperature too cold	2-14
Payload temperature too warm - unit runs	2-15
Display inoperative	2-16
Alarm inoperative/false alarms - unit runs at proper set point	2-17
Excessive frost/condensation in payload compartment - repetitive	2-18
Batteries not charging	2-19

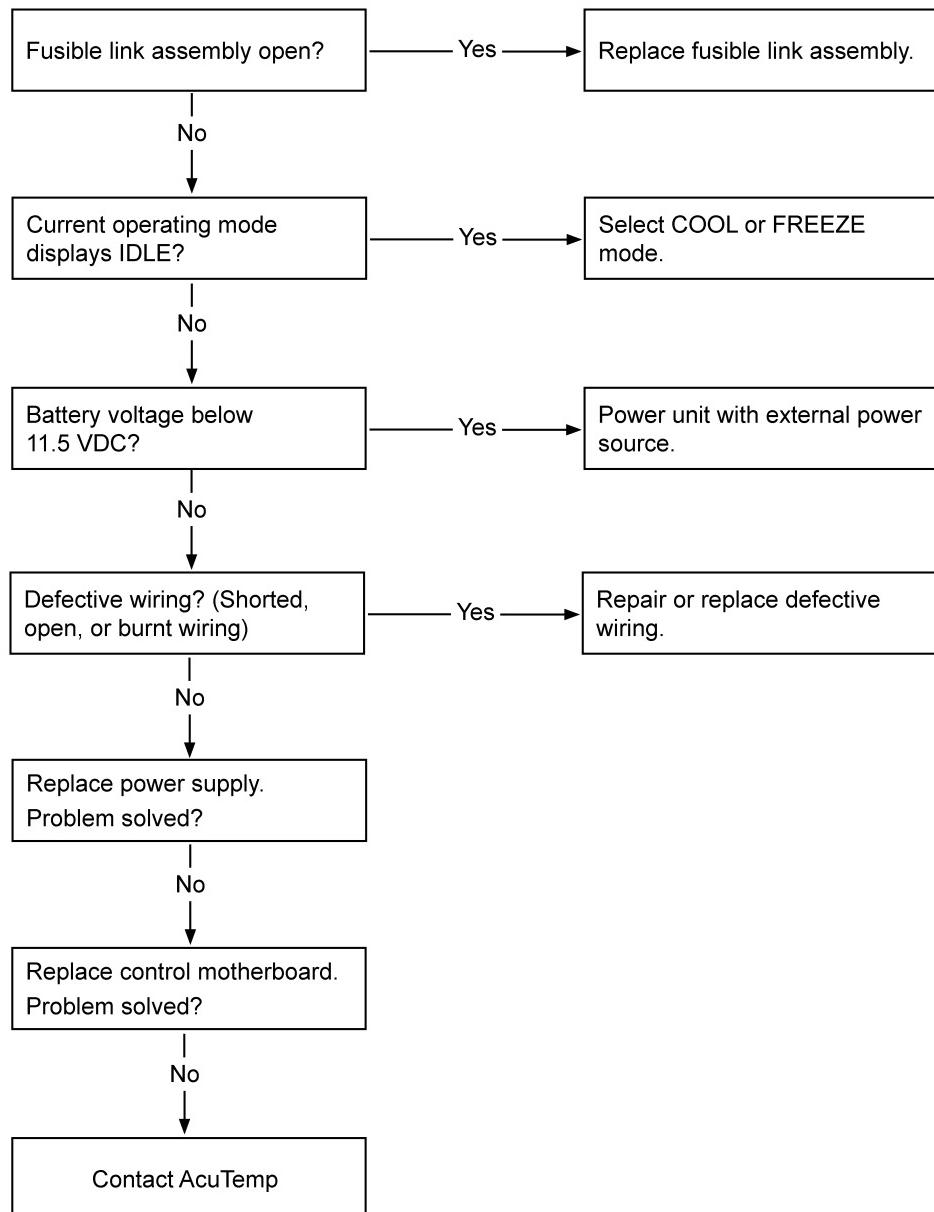
## **HemaCool® Service Manual**

- (2) Follow the question-and-answer sequence or the troubleshooting chart until the solution is reached.
- (3) Troubleshoot to verify cause of problem. When troubleshooting, be aware that secondary deficiencies may be the cause of the problem. Check for cut or damaged wiring and for damaged, missing, or improperly installed components. If deficiencies of this nature are found, do not go any further in the troubleshooting chart. Correct the deficiency and check whether or not the problem has been solved. If not, continue where you left off in the troubleshooting chart.

- (4) If problem cannot be corrected during normal troubleshooting, contact the manufacturer:

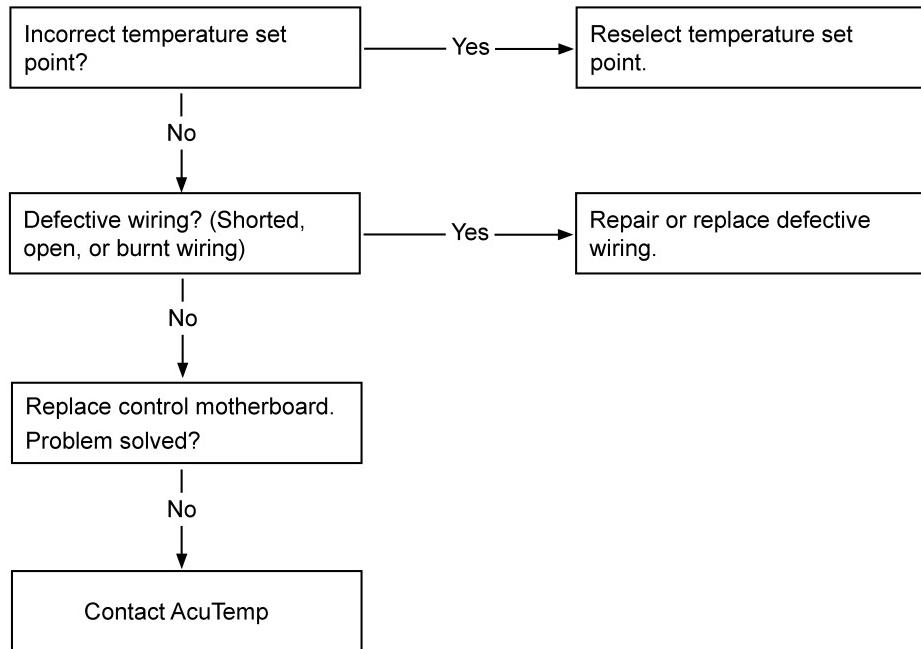
Acutemp  
[www.acutemp.com](http://www.acutemp.com)  
7610 McEwen Rd.  
Dayton, Ohio 45459  
U.S.A  
Telephone: (937) 312-0114  
Fax (937) 312-1277  
**Email: support@acutemp.com**

**Problem: Unit Does Not Work**



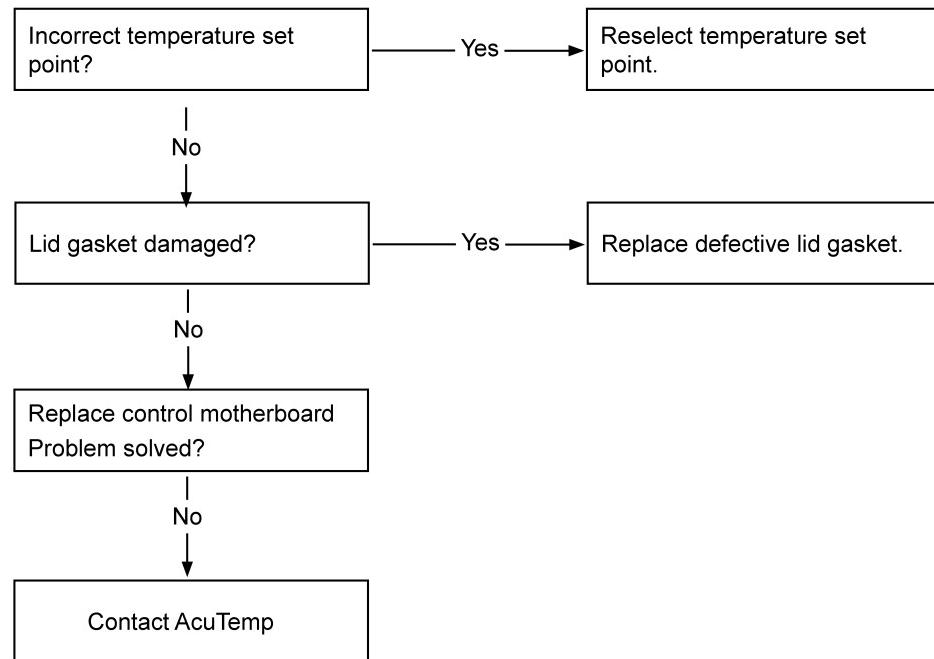
**Figure 2-13.** Troubleshooting, Unit Does Not Work

**Problem: Payload Temperature Too Cold**



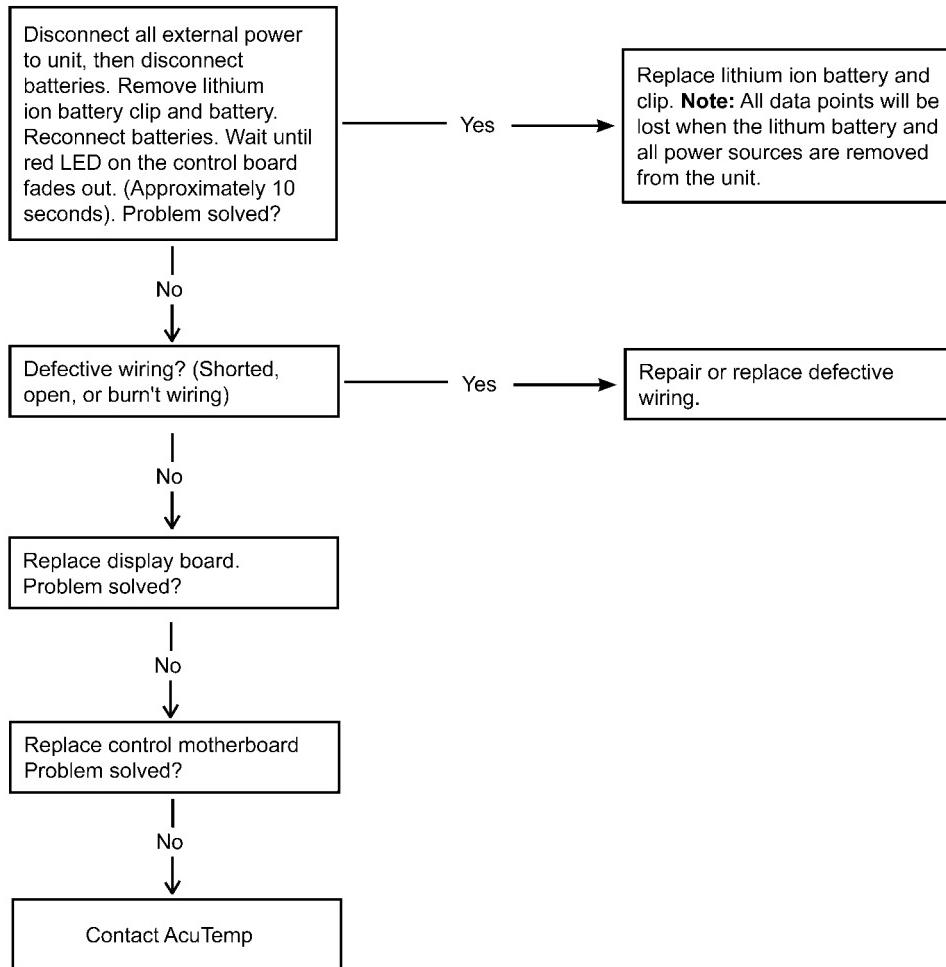
**Figure 2-14.** Troubleshooting, Payload Temperature Too Cold

**Problem: Payload Temperature Too Warm - Unit Runs**



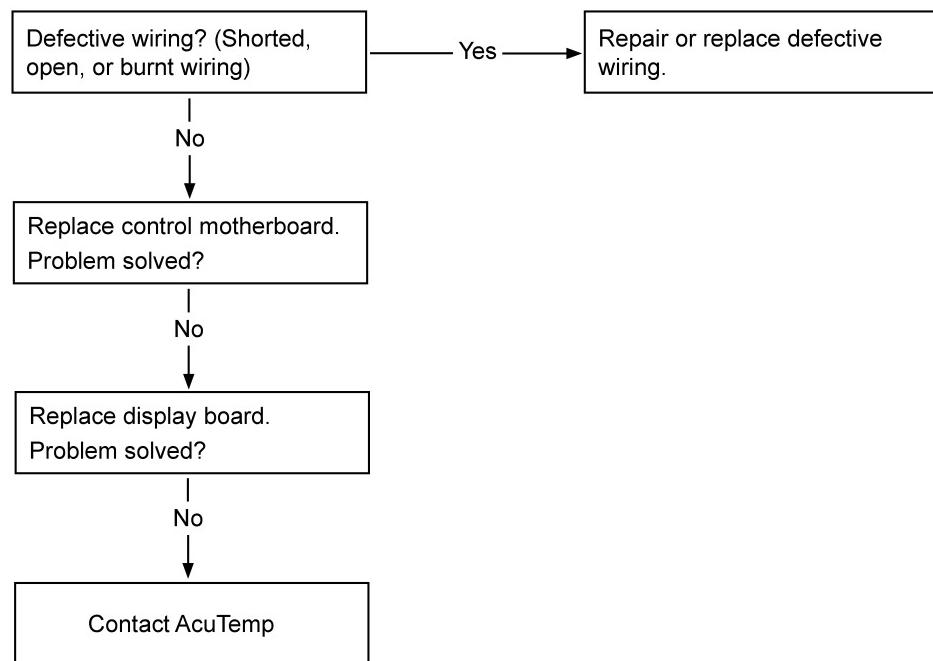
**Figure 2-15.** Troubleshooting, Payload Temperature Too Warm - Unit Runs

**Problem: Display Inoperative**



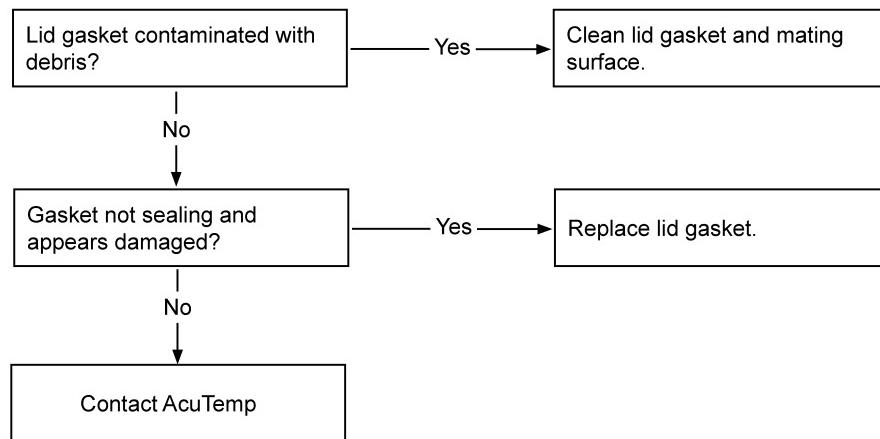
**Figure 2-16.** Troubleshooting, Display Inoperative

**Problem: Alarm Inoperative/False Alarms - Unit Runs at Proper Set Point**



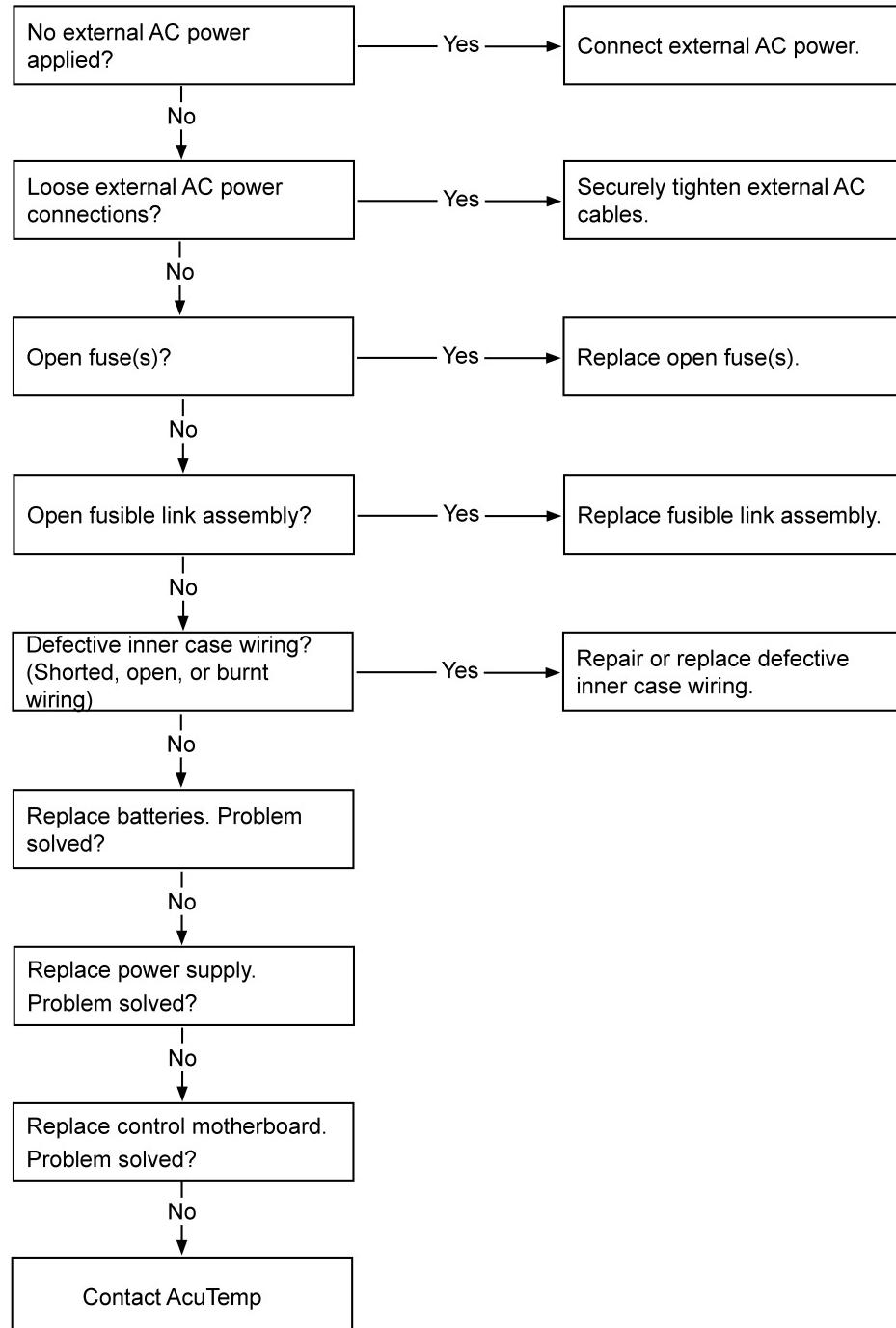
**Figure 2-17.** Troubleshooting, Alarm Inoperative/False Alarms - Unit Runs at Proper Set Point

**Problem: Excessive Frost/Condensation in Payload Compartment - Repetitive**



**Figure 2-18.** Troubleshooting, Excessive Frost/Condensation in Payload Compartment - Repetitive

**Problem: Batteries Not Charging**



**Figure 2-19.** Troubleshooting, Batteries Not Charging

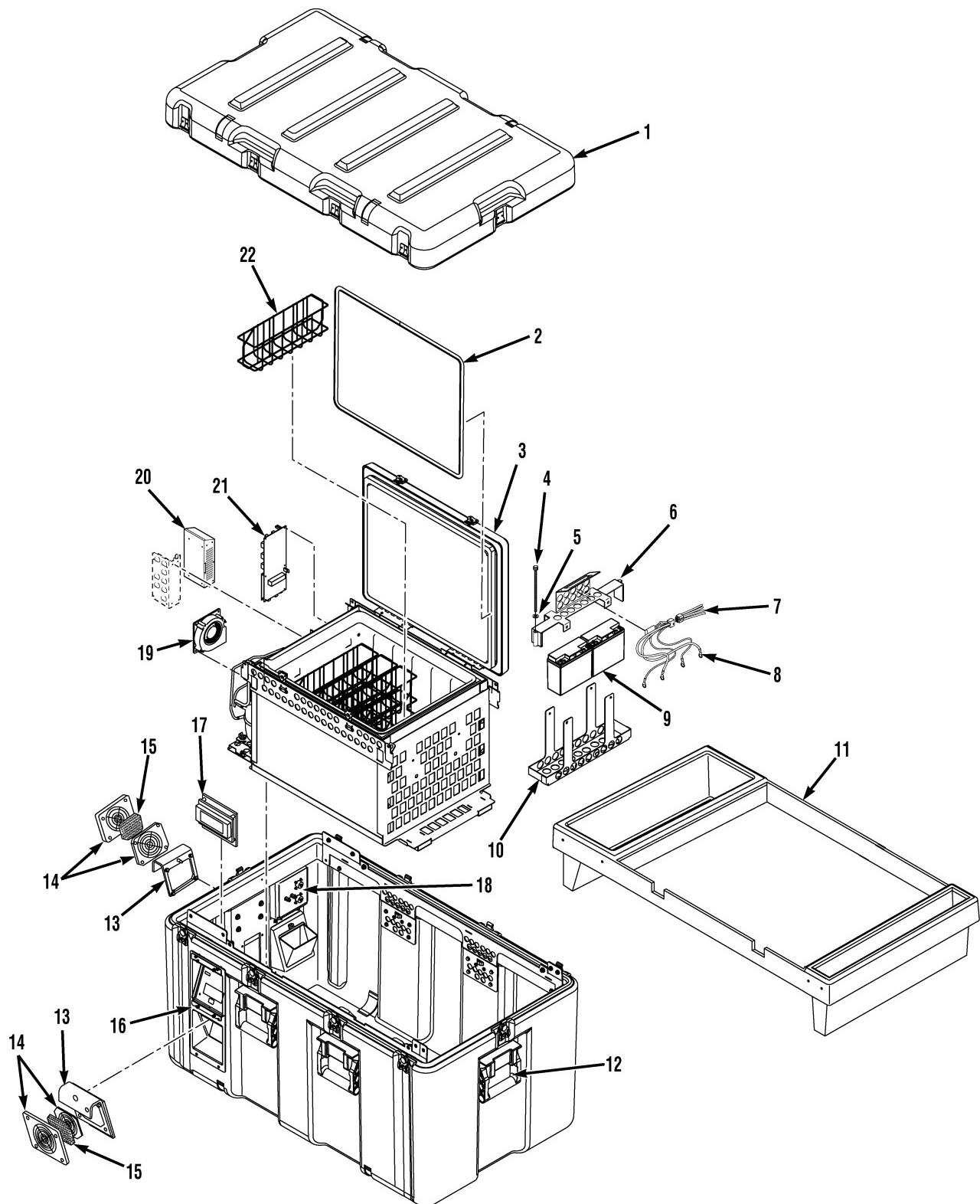


## CHAPTER 3. ILLUSTRATED PARTS LIST

For part identification refer to Figure 3-1.

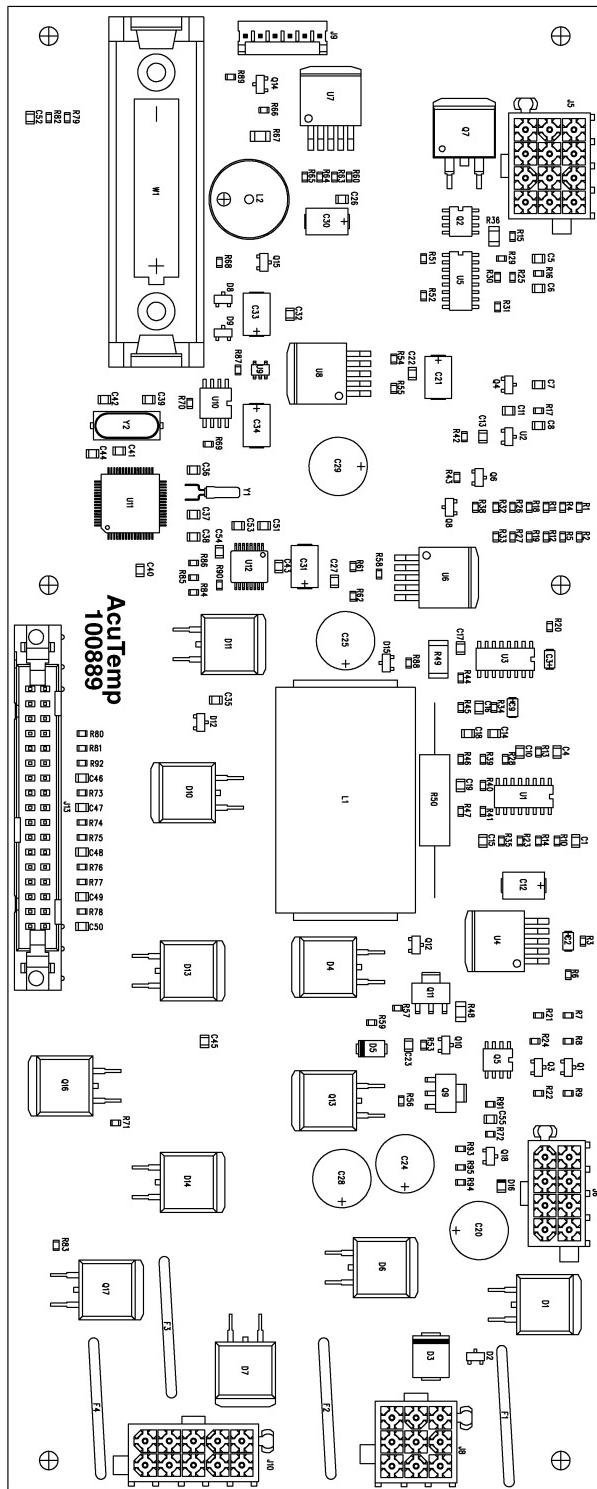
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	100880	Lid, case
2	2	100868	Gasket, lid
3	1	100850	Lid assembly
4	2	101913	Screw, hex-head machine #10-32 x 2.00 Lg
5	2	101917	Washer, .203 ID x .688 OD x .046 Thick
6	1	101892	Battery lockdown bracket
7	1	100955	Battery power harness
8	1	100956	Fusible link assembly
9	2	101880	Battery, 12 V, 21 ah
10	1	101891	Battery compartment
11	1	100945	Cover panel
12	6	100846	Handle assembly
13	2	101927	Air intake filter mount
14	2	101928	Plastic filter assembly
15	2	101964	Replacement filters, bag of 10 (incl. in PN 101957)
16	1	100835	Control panel assembly
17	1	100899	Display main, PC board
18	1	100871	Power panel assembly
19	1	100801	Fan, centrifugal 12VDC
20	1	101763	Power supply
21	1	100889	Control motherboard
22	10	100000	Basket, blood storage
*	1	101839	Compressor power harness
*	2	100523	Fuses, 3-Amp, 3 AG-type
*	1	100970	AC Power Cord (US)
*	1	100968	DC Power Cord
*	1	103014	Battery, 3.6 V, lithium
*	1	103015	Retaining clip
*	1	101957	Manual/Tool kit assembly
*	1	101962	CD - Operation and maintenance (incl. in PN 101957)
*	1	101963	CD - Service and repair (incl. in PN 101957)
*	1	102009	CD - Hemalog software (incl. in PN 101957)
*	1	100631	No. 2 Phillips-head screwdriver (incl. in PN 101957)
*	1	101832	Cellulose sponge (incl. in PN 101957)
*	1	101961	Bubble out storage bag (incl. in PN 101957)
*	1	102010	Manual, operation and maintenance
*	1	102011	Manual, service and repair
*		Various	Hardware, upon request

\* Not Illustrated



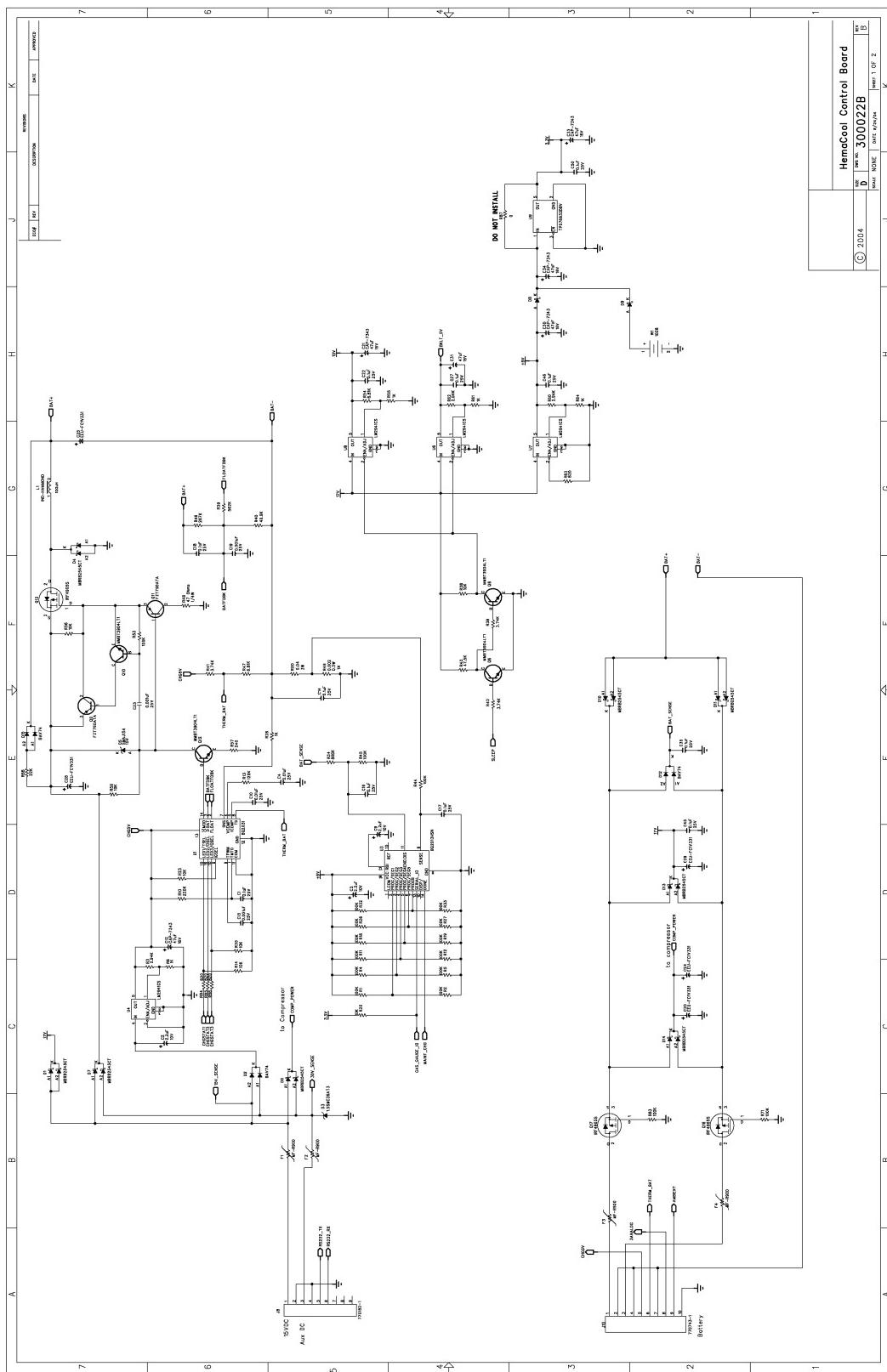
**Figure 3-1.** Replacement Parts

## APPENDIX A. SCHEMATICS AND BOARD LAYOUTS



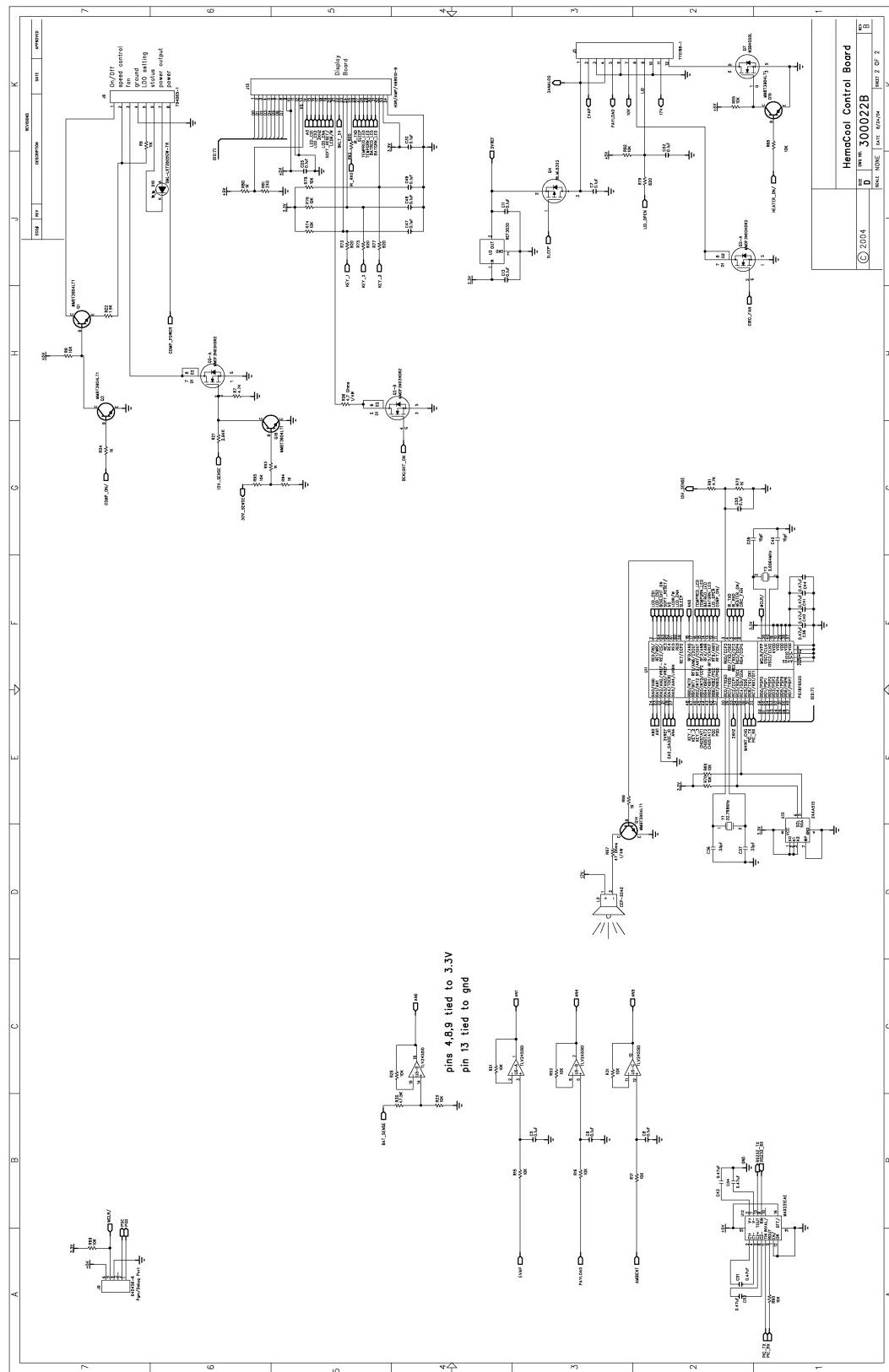
*Figure A-1.* Control Motherboard Layout

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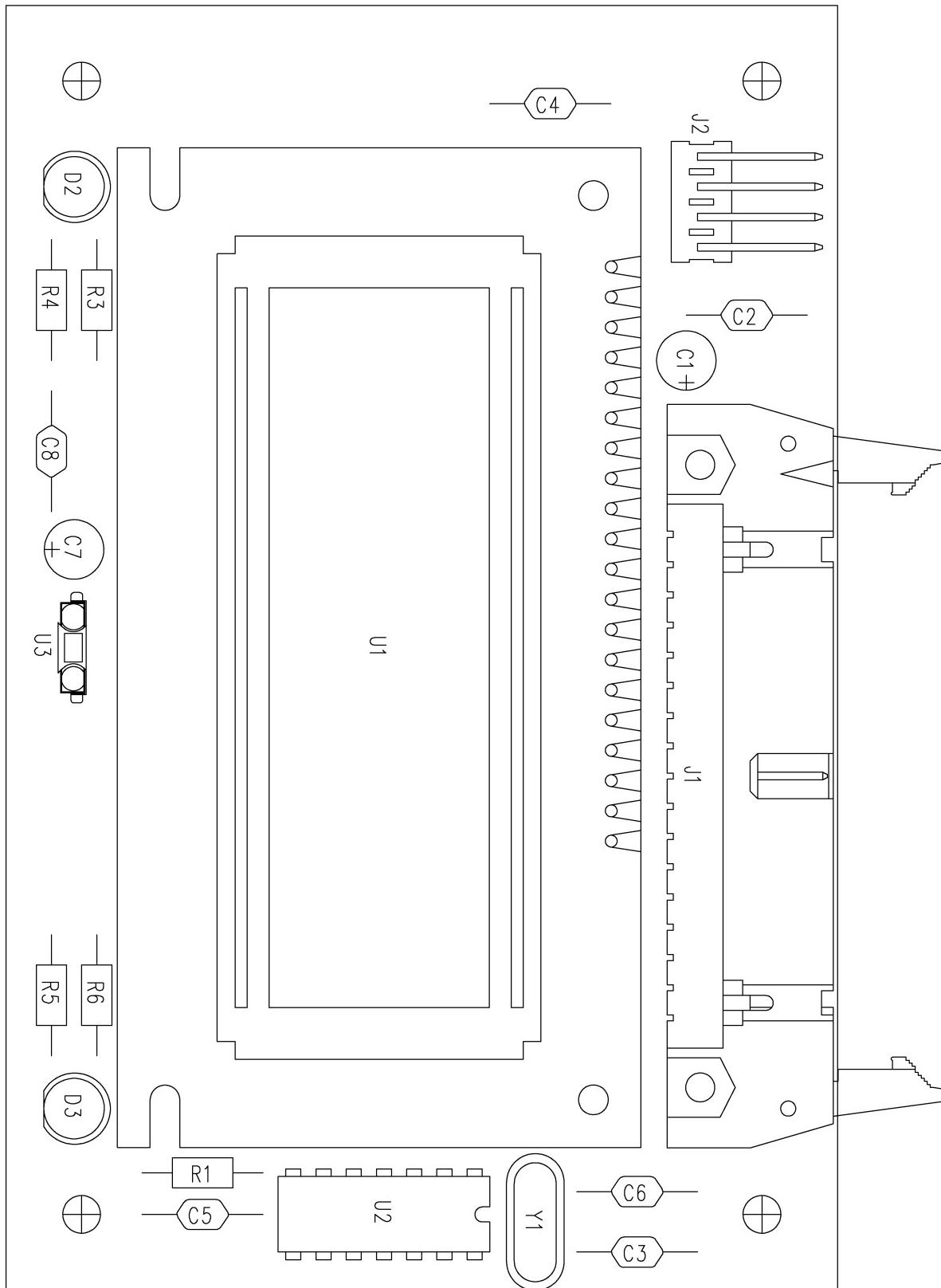


**Figure A-2.** Control Motherboard Schematic (Sheet 1 of 2)

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**Figure A-2.** Control Motherboard Schematic (Sheet 2 of 2)



**Figure A-3.** Display Circuit Board Layout

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